

PROJECT MANUAL – VOLUME 1 OF 2



2024 Cy Ranch High School Additions and Renovations

Cypress-Fairbanks Independent School District
Cypress, Texas



MORE THAN ARCHITECTS

PROJECT MANUAL

Project Name: 2024 Cy Ranch High School Additions and Renovations – Volume 1 of 2
Client Name: Cypress-Fairbanks Independent School District Location: Cypress, Texas
Project Number: 1818-06-01 Date: November 7, 2024

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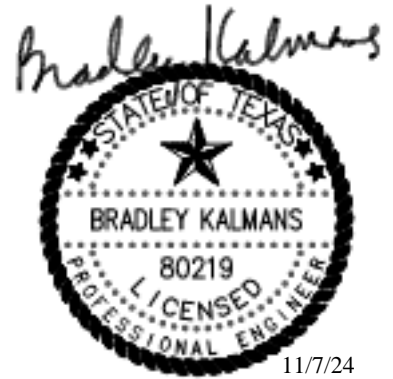
PROJECT TEAM



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**SECTION 00 0115
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- A. Following are the drawings which form a part of the contract, as set forth in subparagraph 1.1.1 of the accompanying "General Conditions of the Contract for Construction".

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AUDIO-VISUAL

AV0.01	AUDIOVISUAL NOTES AND COORDINATION ADVISORIES
AV0.02	AUDIOVISUAL DEVICE LEGEND
AV0.03	AUDIOVISUAL CONDUIT RISER
AV0.10	AUDIOVISUAL DETAILS
AV0.11	AUDIOVISUAL DETAILS
AV0.12	AUDIOVISUAL DETAILS
AV0.13	AUDIOVISUAL DETAILS
AV1.06	AUDIOVISUAL FLOOR PLAN - AREA F - FIRST FLOOR
AV1.07	AUDIOVISUAL FLOOR PLAN - AREA G - FIRST FLOOR
AV1.16	AUDIOVISUAL FLOOR PLANS - AREA F - STAGE GALLERIES
AV2.06	AUDIOVISUAL REFLECTED CEILING PLAN - AREA F - FIRST FLOOR
AV2.07	AUDIOVISUAL REFLECTED CEILING PLAN - AREA G - FIRST FLOOR
AV2.16	AUDIOVISUAL REFLECTED CEILING PLAN - AREA F - SECOND FLOOR
AV6.01	AUDIOVISUAL BUILDING SECTIONS
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AV7.03	AUDIOVISUAL PLATE DETAILS
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AV8.01	AUDIOVISUAL RACK ELEVATIONS
AV9.01	AUDIOVISUAL ONELINE DIAGRAM
AV9.02	AUDIOVISUAL ONELINE DIAGRAM
AV9.03	AUDIOVISUAL ONELINE DIAGRAM
AV9.04	AUDIOVISUAL ONELINE DIAGRAM
AV9.05	AUDIOVISUAL ONELINE DIAGRAM

END OF SECTION



11/07/2024

**SECTION 00 3132
GEOTECHNICAL DATA**

PART 1 - GENERAL

1.01 SUMMARY

- A. Related Documents: General and Supplementary Conditions of the Contract, Division 01 General Requirements, and Drawings are applicable to this Section.

1.02 INVESTIGATION

- A. An investigation of subsurface soil conditions at the building site was authorized by the Owner, and these investigations were made by Raba Kistner, Inc., report number AHA24-31-00, dated September 27, 2024.

1.03 REPORT

- A. The complete report of the testing laboratory follows this section and is provided for information only.
- B. Report and log of borings are available for Contractor's information but is not a warranty of subsurface conditions, nor is it a part of the Contract Documents.

1.04 RESPONSIBILITY

- A. Bidders are expected to examine the site and subsurface investigation reports and then decide for themselves the character of the materials to be encountered.
- B. The Owner and Architect assume no responsibility for variations of subsoil quality or conditions.
- C. The Owner and the Architect assume no responsibility for any conclusions or interpretations made on the basis of subsurface information contained in the contract documents.

PART 2 - NOT USED

PART 3 - NOT USED

END OF SECTION



GEOTECHNICAL ENGINEERING STUDY

FOR

**HUCKABEE PROJECT NO. 01818-06-01
CYPRESS RANCH HIGH SCHOOL (HS) ADDITIONS AND RENOVATIONS
10700 FRY ROAD
CYPRESS, TEXAS 77433**

Project No. AHA24-031-00
July 28, 2024
Revised: September 27, 2024

Ms. Susan Wisa, AIA, Principal
Huckabee
1700 City Plaza Drive
City Place 1, Suite 125
Spring, Texas 77389



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**RE: Geotechnical Engineering Study Report
Huckabee Project No. 01818-06-01
Cypress Ranch High School (HS) Additions and Renovations
10700 Fry Road
Cypress, Texas 77433**

Dear Ms. Wisa:

Raba Kistner, Inc. (Raba Kistner) is pleased to submit this report of our Geotechnical Engineering Study for the above-referenced project. This study was performed in accordance with **Raba Kistner** Proposal No. PHA24-038-00 Revision No. 1, dated June 10, 2024. The purpose of this study was to drill borings within the proposed additions to Cypress Ranch High School, to perform laboratory testing on selected soil samples to classify and characterize subsurface conditions, and to provide foundation and pavement section thickness design and construction recommendations for the proposed facilities. This report has been revised from the original to include updated building foundation design and construction recommendations utilizing drilled and underreamed piers in order to match the existing building's foundation system.

The following report contains our design recommendations and considerations based on our current understanding of the finished floor elevation, design tolerances, and structural and pavement loads. If any of these parameters change, there may be alternatives for value engineering of the foundation and pavement systems, and **Raba Kistner** recommends that a meeting be held with Huckabee (CLIENT) and the design team to evaluate these alternatives.

We appreciate the opportunity to be of service to you on this project. Should you have any questions about the information presented in this report, or if we may be of additional assistance on the materials testing-quality control program during construction, please call.

Very truly yours,
RABA KISTNER, INC.

A handwritten signature in blue ink that reads 'John D. Nguyen'.

John Nguyen, E.I.T.
Graduate Engineer

JN/PTT/JD
Attachments

Copies Submitted: Above (1-Electronic)



Phu T. Tran, P.E.
Project Manager

9/27/2024

GEOTECHNICAL ENGINEERING STUDY

For

**HUCKABEE PROJECT NO. 01818-06-01
CYPRESS RANCH HIGH SCHOOL (HS) ADDITIONS AND RENOVATIONS
10700 FRY ROAD
CYPRESS, TEXAS 77433**

Prepared for

HUCKABEE
Spring, Texas

Prepared by

RABA KISTNER, INC.
Houston, Texas

PROJECT NO. AHA24-031-00

July 28, 2024

Revised: September 27, 2024

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ATTACHMENTS

The following figures are attached and complete this report:

Boring Location Map.....	Figure 1
Logs of Borings	Figure 2 through 9
Key to Terms and Symbols.....	Figure 10 through 12
Results of Soil Sample Analyses	Figure 13 through 14
Grain Size Curve	Figure 15
Important Information About Your Geotechnical Engineering Report	

INTRODUCTION

Raba Kistner, Inc. (Raba Kistner) has completed the authorized subsurface exploration and foundation and pavement section thickness recommendations for the proposed additions to Cypress Ranch High School facilities to be located at 10700 Fry Road in Cypress, Texas. This report briefly describes the procedures utilized during this study and presents our findings along with our recommendations for foundation and pavement section thickness design and construction considerations.

PROJECT DESCRIPTION

We understand that the proposed project consists of the design and construction of multiple, single-story, building additions to the existing High School facility, as well as two additional tennis courts within the athletic field section. The about 11,000 ft² single-story building additions include an independent, free-standing, outdoor storage building, two new art rooms, and a black box building. There is a design option for a two-story art room at the front of the school. In addition, repairs to the existing detention pond located on the eastern portion of the school are planned due to ongoing apparent erosion issues. The educational facility is located at 10700 Fry Road in Cypress, Texas. It is expected that the proposed building additions will consist of conventional construction to include a combination of pre-engineered metal buildings with Concrete Masonry Unit (CMU) block walls and floor slabs supported at grade.

No structural loading parameters were provided to us; however, the proposed building structures are expected to create relatively light to moderate loads to be carried by the foundation systems, which are anticipated to match the building's existing foundation system. For the outdoor storage building, the foundation system is anticipated to consist of a shallow or deep foundation such as spread footings or drilled-and-underreamed piers. Similarly, the foundation system for the tennis courts is anticipated to consist of a beam and slab post-tensioned system. Buildings' floor systems consisting of slabs-on-ground is expected to be preferred, provided soil-related, potential vertical movements will not cause structural performance problems. The pavement system is anticipated to consist of rigid (concrete) pavement.

The geotechnical investigation for the tennis courts will be performed in general accordance with Post-Tensioning Institute (PTI) recommendations provided soil-related, potential vertical movements can be limited to 1-inch or less.

LIMITATIONS

This engineering report has been prepared in accordance with accepted Geotechnical Engineering practices in the Southeast Texas area by Geotechnical firms conducting similar work under similar circumstances and is meant for the use of CLIENT and its representatives for design purposes. This report may not contain sufficient information for purposes of other parties or other uses and is not intended for use in determining construction means and methods.

The recommendations submitted in this report are based on the data obtained from eight (8) borings drilled at this site, our understanding of the project information provided to us by others, and the assumption that site grading will result in only minor changes in the existing topography. If the project

information described in this report is incorrect, is altered, or if new information is available, we should be retained to review and modify our recommendations.

This report may not reflect the actual variations of the subsurface conditions across the site. The nature and extent of variations across the site may not become evident until construction commences. The construction process itself may also alter subsurface conditions. If variations appear evident at the time of construction, it may be necessary to reevaluate our recommendations after performing on-site observations and tests to establish the engineering impact of the variations.

The scope of our Geotechnical Engineering Study does not include an environmental assessment of the air, soil, or water conditions either on or adjacent to the site. No environmental opinions are presented in this report. **Raba Kistner**'s scope of work does not include the investigation, detection, or design related to the prevention of any biological pollutants. The term "biological pollutants" includes, but is not limited to, mold, fungi, spores, bacteria, and viruses, and the byproduct of any such biological organisms.

If final grade elevations are significantly different from those provided to us by others by more than plus or minus 1-ft, our office should be informed about these changes. If needed and/or if desired, we will reexamine our analyses and make supplemental recommendations.

BORINGS AND LABORATORY TESTS

Subsurface conditions at the site were evaluated by eight borings (designated as Borings B-1 through B-8) drilled at the locations shown on the Boring Location Map, Figure 1. The boring locations are approximate and were located in the field by a **Raba Kistner** representative based on a site plan provided by Huckabee, and by measuring distances from existing references. Latitude-longitude values at the boring locations were estimated using Google Earth. The coordinates are shown on the boring logs, Figures 2 through 9.

The borings were drilled to depths ranging from about 10 ft to 30 ft below the ground surface elevation existing at the time of our study using a truck-mounted drilling rig and utilizing solid flight augers. At completion of drilling, the cuttings from drilling activities and bentonite chips were used to backfill the open boreholes. During drilling operations, the following samples were collected:

Table 1 – Soil Sampling Methods and Quantities

Type of Sample	Number Collected
Undisturbed Shelby Tube (ST)	7
Standard Penetration Test (SPT)	52
Grab Sample	2

The ST and SPT samples were obtained in general accordance with American Society for Testing and Materials (ASTM) Standard Procedures. ST samples were recovered in cohesive soils using a thin-walled metal tube sampler (minimum 3-inch inside diameter) that complies with ASTM D1587 requirements. The

SPT results are noted as “blows per foot” on the boring logs. The term “blows per foot” refers to the number of blows by a 30-inch free falling 140-lb hammer required for 12-inches of penetration into the subsurface materials. Grab samples were collected from the auger cuttings during drilling. Representative portions of the samples were sealed in containers to reduce moisture loss, labeled, packaged, and transported to our laboratory for subsequent testing and classification.

In the laboratory, each sample was evaluated and visually classified by a member of our Geotechnical Engineering staff in general accordance with the Unified Soil Classification System (USCS). The geotechnical engineering properties of the strata were evaluated by the laboratory tests tabulated in Table 2:

Table 2 – Laboratory Test Quantities

Type of Test	Number Conducted
Natural Moisture Content (ASTM D2216)	64
Atterberg Limits (ASTM D4318)	16
Percent Passing a No. 200 Sieve (ASTM D1140)	26
Hydrometer Analysis (ASTM D7928)	2
Unconfined Compression (ASTM D2166)	2
Unconsolidated-Undrained Triaxial Compression (ASTM D2850)	1

The results of the laboratory tests are presented in graphical or numerical form on the boring logs illustrated on Figures 2 through 9. A key to the classification of terms and symbols used on the logs is presented on Figures 10 through 12. The results of the laboratory and field testing are also tabulated on Figures 13 through 14. The results of the sieve analyses have been plotted on the attached Grain Size Curve on Figure 15 for ease of reference.

Samples will be retained in our laboratory for 30 days after submittal of this report. Other arrangements may be provided at the request of the CLIENT.

GENERAL SITE CONDITIONS

GEOLOGY

According to the Geologic Atlas of Texas, Houston Sheet (Revised 1982) shows the subject site to be located on the Lissie Formation. The Pleistocene Lissie Formation upper part is a fluvial deposit and consists of clay, silt, sand, and very minor siliceous gravel of granule and small pebble size, gravel more abundant northwestward, locally calcareous, concretions of calcium carbonate, iron oxide, and iron manganese oxides common in zone of weathering; fluvial; surface fairly flat and featureless except for numerous rounded shallow depressions and pimple mounds. The lower part consists of clay, silt, sand, and minor amount of gravel; gravel slightly coarser than in upper part, noncalcareous, iron oxide concretions more abundant than in upper part; fluvial; very gently rolling.

SEISMIC COEFFICIENTS

On the basis of the soil borings conducted for this investigation, the upper 30 feet of subgrade soils may be characterized primarily as stiff soil and a **Class D** Site Class Definition (Chapter 20 of ASCE 7) has been assigned to this site.

On the basis of the Structural Engineers Association of California (SEAOC) website¹ which utilizes the ASCE 7-16 and International Building Code (IBC) and U.S. Seismic Design Maps to develop seismic design parameters, the following seismic considerations are associated with this site.

- **$S_s = 0.067g$**
- **$S_1 = 0.039g$**
- **$S_{ms} = 0.107g$**
- **$S_{m1} = 0.094g$**
- **$S_{DS} = 0.072g$**
- **$S_{D1} = 0.062g$**

Based on the parameters listed above as well as Tables 1613.3.5(1) and 1613.3.5(2) of the 2015 IBC, the Seismic Design Category for both short period and 1 second response accelerations is **A**. As part of the assumptions required to complete the calculations, a Risk Category of “III” was selected.

STRATIGRAPHY

The subsurface conditions encountered at the boring locations are shown on the boring logs, Figures 2 through 9. The boring logs should be consulted for boring specific (detailed) stratigraphic information. These boring logs represent our interpretation of the subsurface conditions based on the field logs, visual examination of field samples by our personnel, and laboratory test results of selected field samples. Each stratum has been designated by grouping soils that possess similar physical and engineering characteristics. The lines designating the interfaces between strata on the boring logs represent approximate boundaries. Transitions between strata may be gradual.

Near-surface granular soils are primarily encountered below the existing grade. These soils consist of loose to dense relative density, clayey sand (SC), poorly-graded sand with silt (SP-SM), and silty sand (SM). Ferrous and calcareous nodules, silt seams and few gravel were noted at varying depths within the granular soils. Measured moisture contents range from 6 to 24 percent. Measured plasticity indices (PI) range from 10 to 25 percent. Based on grain size analysis, the percentage of fines (percent passing a No. 200 sieve) within this stratum is 5 to 47 percent. SPT N-values ranging from 6 to 44 blows per one foot of penetration were recorded.

Additionally, intermittent cohesive soil layers are encountered in Borings B-2, B-4, B-5, B-7 and B-8 within the granular layer. These soils were comprised of Sandy Lean Clay (CL) and Fat Clay (CH). Measured moisture contents range from 7 to 44 percent. Measured PI range from 8 to 37 percent. Based on grain size analysis, the percentage of fines (percent passing a No. 200 sieve) within this stratum is 53 to 93

¹<https://seismicmaps.org/>

percent. Undrained shear strength values range from 0.49 tsf to 0.72 tsf based on unconfined compressive strength tests and unconsolidated undrained triaxial compression tests. The tested samples had dry unit weights ranging from 91 pcf to 120 pcf. SPT N-values ranging from 8 to 25 blows per one foot of penetration were recorded.

GROUNDWATER

Groundwater was observed in Boring B-1 through B-6. Groundwater depth readings for this boring are listed in the following table:

Table 3 – Groundwater Depth Readings

Boring No.	Depth Groundwater Encountered during Drilling (ft)	Water Level Depth after 15 Minutes (ft)
B-1	15	14
B-2	17	15.5
B-3	15	13.5
B-4	14	13
B-5	14	13
B-6	14	10.5

It is possible for groundwater to exist beneath this site at shallow depths on a transient basis, particularly in interbedded sand seams following periods of precipitation. Fluctuations in groundwater levels are possible due to variations in rainfall and surface water run-off. The construction process itself may also cause variations in the groundwater levels.

Based on the findings in our borings and on our experience in this region, we believe that groundwater seepage encountered during site earthwork activities and foundation construction may be controlled using temporary earthen berm and conventional sump-and-pump dewatering methods.

FOUNDATION ANALYSIS

EXPANSIVE SOIL-RELATED MOVEMENTS

The anticipated ground movements due to swelling of the underlying soils at the site were estimated for slab-on-grade construction using the empirical procedure, Texas Department of Transportation (TxDOT) Tex-124-E, Method for Determining the Potential Vertical Movement (PVM). A PVM value on the order of about ¾ inch was estimated for the stratigraphic conditions encountered in our borings. A surcharge load of 1 psi (5-inch thick concrete slab and 6 inches of select fill above existing grade), an active zone of 8 ft, and dry moisture conditions were assumed in estimating the above PVM value.

The TxDOT method of estimating expansive soil-related movements is based on empirical correlations utilizing the measured plasticity indices and assuming typical seasonal fluctuations in moisture content. If desired, other methods of estimating expansive, soil-related movements are available, such as

estimations based on swell tests and/or soil-suction analyses. However, the performance of these tests and the detailed analysis of expansive soil-related movements were beyond the scope of the current study. It should also be noted that actual movements can exceed the estimated PVM values due to isolated changes in moisture content (such as due to leaks, landscape watering....) or if water seeps into the soils to greater depths than the assumed active zone depth due to deep trenching or excavations.

Overexcavation and Select Fill Replacement

To reduce expansive, soil-related movements in at-grade construction, a portion of the upper expansive subgrade clays within the building area can be removed by overexcavating and backfilling with a suitable select fill material. A potential PVM value of ½ inches or less is recommended for the proposed structures, based on our understanding of the buildings' long-term performance and future maintenance requirements as discussed via telephone conversation with Mr. Brendon Hoffman (CLIENT representative) on October 12, 2023. The information provided to us by Mr. Hoffman was based on his telephone conversation on the same date with Mr. Matt Morgan, who is the Owners Designated Representative (ODR) with Cypress-Fairbanks ISD. Based on our analysis, a 4-ft thick select fill pad is needed to achieve a ½ inch PVM. Recommendations for the selection and placement of select backfill materials are addressed in a subsequent section of this report.

Based on the site grading information provided from the CLIENT, we understand that the new buildings' finished floor elevation (FFE) is about 0.5 ft to 1 ft above existing grades. Therefore, final subgrade elevation will be approximately 0.5 ft below FFE, assuming a 6-inch thick concrete floor slab.

Select Fill Overbuild. We recommend that the overexcavation extend a minimum of 5 ft beyond the buildings footprints and sloped up towards the adjacent grade, where permissible. Where the potential for differential movement is objectionable (particularly at the entry ways), it may be beneficial to consider methods of reducing anticipated movements (e.g. sloping the building pad overbuild excavation at a slope at 1V:1H, or flatter; or constructing a hinge slab bearing on the foundation with a turned-down edge at the edge of flatwork can be considered). To maintain the estimated PVM values, subsequent fill placed in the select fill pad area should consist of select fill material in accordance with the *Select Fill* section of this report. The overexcavated onsite soils may be reused on site as general fill but must be placed beyond the proposed select fill pad area.

Landscaping Adjacent to Building Pad. Moisture content fluctuation may result from the presence of vegetation in proximity to buildings and adversely affect the performance of slabs-on-grade. As such, we recommend that vegetation, if any, requiring large amounts of water be kept away from buildings. An arborist or other qualified representative should be consulted to address the actual distance of vegetation, water demand of vegetation, and the use of moisture barrier and root barriers to minimize moisture content fluctuation caused by vegetation.

Drainage Considerations. When overexcavation and select fill replacement is selected as a method to reduce the potential for expansive soil-related movements at any site, considerations of surface and subsurface drainage may be crucial to construction and adequate foundation performance of the soil-supported structures. Filling an excavation in relatively impervious plastic clays with relatively pervious

select fill material creates a “bathtub” beneath the structure, which can result in ponding or trapped water within the fill unless good surface and subsurface drainage is provided.

Water entering the fill surface during construction or entering the fill exposed beyond the building lines after construction may create problems with fill moisture control during compaction and increased access for moisture to the underlying expansive clays both during and after construction. Many variables that influence fill drainage considerations may depend on factors that are not fully developed in the early stages of design. For this reason, drainage of the fill should be given consideration at the earliest possible stages of the project.

BUILDING FOUNDATION RECOMMENDATIONS

FOUNDATION CONSIDERATIONS

Our review of the borings and test data indicate that the following factors may affect the foundation design and construction at this site:

- The estimated PVM is less than an inch. Lightly-loaded shallow foundations would not be susceptible to excessive movement from shrink-swell with variation in soil moisture.
- The subsurface soils consist of sandy clays and clayey sand. These soils are susceptible to caving.
- The existing building structure is supported on drilled and underreamed piers at a depth of about 8 ft.

SITE GRADING

Site grading plans can result in changes in almost all aspects of foundation recommendations. We have prepared the foundation recommendations based on the existing and proposed finished floor elevations discussed throughout this report. If site grading plans differ from those discussed in this report by more than plus or minus 1 ft, **Raba Kistner** must be retained to review the site grading plans prior to bidding the project for construction. This will enable us to provide input for any changes in our original recommendations, which may be required as a result of site grading operations or other considerations.

EXISTING FOUNDATIONS

We understand that the proposed building additions will tie into the existing main building. Therefore, we recommend that appropriate measures be taken not to undermine the existing foundations during construction of the building additions. Also, care should be taken during the foundation design to prevent overstressing of the existing foundations. We recommend reviewing the construction drawings of the existing building to verify the locations of the building foundations. Flexible connections should be included in the design to accommodate potential differential movement between the building additions and the existing building.

DRILLED FOOTINGS (DRILLED-AND-UNDERREAMED AND STRAIGHT-SIDED PIERS)

We anticipate that the new building additions will be supported on drilled and underreamed piers. We recommend that piers extend to a depth of 8 ft below the ground surface elevation existing at the time of our study, or to a depth that includes the thickness of any select fill to achieve final ground surface elevation, whichever is greater. The piers should be designed as end bearing units using a maximum allowable bearing pressure of 3,000 psf. This bearing pressure was evaluated using a factor of safety of 3 with respect to the design shear strength.

Due to the presence of sandy clays in most of the borings, we recommend that the bell-to-shaft diameter ratio not exceed 2. If the underream collapses during belling, straight-sided piers equal to the diameter of the underream should be constructed.

Settlement Considerations

A detailed settlement analysis for the building foundations was beyond the scope of this study. However, based on our experience, we expect vertical settlements for isolated drilled-and-underreamed and straight-sided piers to be on the order of ½ to 1 inch. Differential settlements are expected to be approximately half to the total settlement assuming the footings are spaced at least one diameter away from each other.

GRADE BEAMS

Grade beams interconnecting the piers may bear on properly prepared select fill and should be sized to support the design loads. Grade beams should have a minimum width and depth of 12-inches and 18-inches, respectively, and a maximum allowable bearing pressure of 1,800 psf.

FLOOR SLABS

The floor slab could be grade-supported on properly prepared select fill having the necessary thickness to limit PVM to ½-inch or less. We recommend that a vapor barrier comprised of polyethylene or polyvinylchloride (PCV) sheeting be placed between the supporting soils and the concrete floor slab. Vapor barrier/retarder shall meet the specifications for durability and permeance set forth in ASTM E1745.

TENNIS COURTS RECOMMENDATIONS

The project also includes the construction of new tennis courts to be situated on the southwest side of the project site. Our analysis is based on the project Borings B-5 and B-8. The soils encountered within this boring consists of sandy lean clay (CL) and silty sand (SM). We understand that the proposed tennis court will be a post-tensioned slab-on-grade.

POST-TENSIONED SLAB-ON-GRADE DESIGN

Post Tensioning Institute (PTI) design parameters were estimated for existing stratigraphic conditions using the procedures and criteria discussed in the Post-Tensioning Institute Manual entitled “*Design of Post-Tensioned Slabs-on-Ground, Third Edition*” dated 2004 with the 2008 supplement.

Differential vertical swell has been estimated for center lift and edge lift conditions for use in designing foundation slabs for the stratigraphy encountered in our borings. These values were determined using a computer program entitled VOLFLO Win 1.5, as recommended by the Post Tensioning Institute. As recommended by PTI, we have evaluated differential swell for both 1) conditions varying from equilibrium and 2) conditions varying between extremes (wet/dry). The values for both of these conditions are presented in the following tables. Because soil moisture conditions are likely to vary from wet to dry and dry to wet over many cycles during the lifetime of the structure, we recommend that the conditions varying between the extremes be assumed for design. We have also evaluated the various conditions both without (Design condition A) and with (Design condition B) a 30 in. vertical moisture barrier (exterior grade beam).

Table 4 – Without Vertical Moisture Barrier (Design Condition A)

Design Condition	Structure	Edge Moisture Variation Distance (CL), ft	Edge Moisture Variation Distance (EL), ft	Differential Swell (in.)			
				From Equilibrium to Wet	From Equilibrium to Dry	From Dry to Wet	From Wet to Dry
A	Tennis Courts	9.0	4.9	1/4 (EL)	1/2 (CL)	1¼ (EL)	3/4 (CL)

(EL) Edge Lift Condition (CL) Center Lift Condition

Table 5 – With Vertical Moisture Barrier (30-inch, Minimum, Exterior Grade Beam – Design Condition B)

Design Condition	Structure	Edge Moisture Variation Distance (CL), ft	Edge Moisture Variation Distance (EL), ft	Differential Swell (in.)			
				From Equilibrium to Wet	From Equilibrium to Dry	From Dry to Wet	From Wet to Dry
B	Tennis Courts	9.0	4.9	1/4 (EL)	1/4 (CL)	1/2 (EL)	1/4 (CL)

(EL) Edge Lift Condition (CL) Center Lift Condition

Additional design parameters are summarized in the following table:

Table 6 – Additional Design Parameters

PTI Design Parameters	
Percent Fine Clay	30 ⁽¹⁾
Depth to Constant Suction, ft	7 ft

PTI Design Parameters	
Thornthwaite Index, IM	+18
Constant Soil Suction	3.5 pF

⁽¹⁾Based on hydrometer test results and our experience with similar soils

Initial and Final Suction at Edge: Geographical areas with Im less than -15 and greater than +15 should generally use the Post-Equilibrium Case² which The Post-Equilibrium Case assumes swell is calculated from equilibrium to the wet profile, and shrink is calculated from equilibrium to the dry profile. For comparison purposes, a suction value of 2.5 pF corresponds to the wettest soil condition possible if measured under soaking conditions, which is typical of poor drainage or excessive wetting. The driest soil condition (at the surface) is 4.5 pF if the surface suction is controlled by vegetation, or 6.0 pF if the surface suction is controlled by evaporation from bare soil, or soil with wilted vegetation. A suction value of about 3.5 pF corresponds to the plastic limit. We assumed ground surface suction values of 4.5 pF and 3.0 pF for respective dry and wet moisture condition in VOLFLO analysis.

DETENTION POND CONSTRUCTION AND RECOMMENDATIONS

Repairs are planned for the existing detention pond located on the east side of the property. The soil stratigraphy within the existing detention pond footprint, as explored by Borings B-6 and B-7, consists of cohesive, moderate plasticity, stiff consistency, Sandy Lean Clay (CL), semi-cohesive Clayey Sand (SC), and cohesionless Silty Sand (SM).

BANK SLOPE STABILITY AND EROSION RESISTANCE

The stability of the exposed and inundated bank sections and their resistance to erosion are major concerns from a functional and aesthetic standpoint. Based on the anticipated depth expected to match that of the existing pond, design side slope inclinations of 1(V): 3(H) should be stable when considering global stability. Overbank runoff may be minimized by construction back-slope swales to intercept and collect surface runoff. Concrete lining or riprap may be necessary around pipe inlets and outlets if erosive velocities and turbulence are expected.

Some erosional distress should be expected on exposed slopes that are subjected to overbank runoff or are located in the zone of temporary inundation by varying detention levels or wave action. Overbank runoff may be minimized by construction back-slope swales to intercept and collect surface runoff. An additional erosion control measure could include the use of rip rap if grass cover does not provide a good response.

²Design of Post-Tensioned Slabs-on-Ground, 3rd Edition with 2008 Supplement, page 22.

MAINTENANCE

Major maintenance for detention ponds involves removal of vegetation, repair of perimeter banks, and trash removal. Manual removal of vegetation is very expensive and would require removal at frequent intervals. Pond design can be a more effective means of controlling vegetation.

The need for bank repair is generally dictated by the bank height, bank slope, in situ soils, wave action, and effectiveness of the perimeter drainage away from the pond. Properly designed perimeter retention systems require little or no maintenance. Mechanically-protected slopes demand a slightly greater maintenance effort. Unprotected slopes require the greatest maintenance effort.

GENERAL CONSTRUCTION CONSIDERATIONS

SITE DRAINAGE

Drainage is an important key to the successful performance of any structure. Good surface drainage should be established prior to and maintained after construction to help prevent water from ponding within or adjacent to the building structures and to facilitate rapid drainage away from the building foundations. Failure to provide positive drainage away from the structures can result in localized differential vertical movements in soil supported foundations and floor slabs (which can in turn result in cracking in the sheetrock partition walls and shifting of ceiling tiles, as well as improper operation of windows and doors).

Current ordinances, in compliance with the Americans with Disabilities Act (ADA), may dictate maximum slopes for walks and drives around and into new buildings. These slope requirements can result in drainage problems for buildings supported on expansive soils. We recommend that, on all sides of the building, the maximum permissible slope is provided away from the buildings.

Also, to help control drainage in the vicinity of the new building structures, we recommend that roof/gutter downspouts and landscaping irrigation systems not be located adjacent to the building foundations. Where a select fill overbuild is provided outside of the floor slab/foundation footprint, the surface should be sealed with an impermeable layer (pavement or clay cap) to reduce infiltration of both irrigation and surface waters. Careful consideration should also be given to the location of water bearing utilities, as well as to provisions for drainage in the event of leaks in water bearing utilities. All leaks should be immediately repaired.

As with any soil-supported structure such a track and field system, the satisfactory performance of the structure is contingent on the provision of adequate surface and subsurface drainage. Insufficient drainage which allows saturation of the supporting granular pavement materials will greatly reduce the performance and service life of the track and field system, even when the system is constructed using either typical cross-section guidelines or design recommendations based on site-specific soils testing.

Other drainage and subsurface drainage issues are discussed in the *Foundation Analysis* section of this report and under the *Pavement Construction Considerations* section of this report.

SITE PREPARATION

Building areas and areas to support select fill should be stripped of vegetation, roots, and other deleterious materials. After stripping and grubbing, the exposed subgrade should be thoroughly proofrolled in order to locate and densify weak, compressible zones. A minimum of 5 passes of a fully-loaded dump truck or a similar heavily-loaded piece of construction equipment should be used for planning purposes. Proofrolling operations should be observed by the Geotechnical Engineer or his representative to document subgrade condition and preparation. Weak or soft areas identified during proofrolling should be removed and replaced with suitable, compacted on-site clays, free of organics, oversized materials, and degradable or deleterious materials.

Upon completion of the proofrolling operations and just prior to fill placement or slab construction, the exposed subgrade should be moisture conditioned by scarifying to a minimum depth of 6 in. and recompacting to a minimum of 95 percent of the maximum dry density as determined by ASTM D698. The moisture content of the subgrade should be maintained within two percentage points of the optimum moisture content until permanently covered.

WET WEATHER CONDITIONS

Earthwork contractors should be made aware of the moisture sensitivity of the near surface soils and potential compaction difficulties. If construction is undertaken during wet weather conditions, the surficial soils may become saturated, soft, and unworkable. Drainage trenches within the soils to be excavated, reworked and/or recompacted may be required. Additionally, subgrade treatment techniques, such as chemical treatment (flyash or hydrated lime, depending on predominant soil type), may be required to provide a more weather-resistant working surface during construction. Therefore, we recommend that consideration be given to construction during the dryer months. Recommendations for subgrade treatment are presented in subsequent sections of this report. Alternatively, the contractor should protect exposed areas once topsoil has been stripped, as well as provide positive drainage during earthwork operations.

SELECT FILL

Materials used as select fill for final site grading preferably should be inert cohesive/semi-cohesive sandy lean clays (CL)/clayey sands (SC) as classified according to the USCS, may be considered satisfactory for use as select fill materials at this site. Select fill materials shall have a maximum liquid limit not exceeding 40 percent, a plasticity index between 7 and 18 percent, and a maximum particle size not exceeding 4 in. or one-half the loose lift thickness, whichever is smaller. In addition, if these materials are utilized, grain size analyses and Atterberg Limits must be performed during placement at a minimum rate of one test each per 5,000 cubic yards of material due to the high degree of variability associated with pit-run materials.

If the above listed materials are being considered for bidding purposes, the materials should be submitted to the Geotechnical Engineer for pre-approval at a minimum of 10 working days or more prior to the bid date. Failure to do so will be the responsibility of the contractor. The contractor will also be responsible for ensuring that the properties of all delivered alternate select fill materials are similar to those of the pre-approved submittal. It should also be noted that when using alternative fill materials, difficulties may be

experienced with respect to moisture control during and subsequent to fill placement, as well as with erosion, particularly when exposed to inclement weather. This may result in sloughing of beam trenches and/or pumping of the fill materials.

Soils classified as CH, MH, ML, SM, GM, OH, OL and Pt under the USCS are **not** considered suitable for use as select fill materials at this site. Some of the surficial soils observed in the project borings are suitable for use as select fill materials. We recommend additional sampling and testing of the near-surface soils to more accurately assess the quantity of select fill available for construction.

Select fill should be placed in loose lifts not exceeding 8 in. in thickness and compacted to at least 95 percent of maximum density as determined by ASTM D698. The moisture content of the fill should be maintained within the range of 2 percentage points below to 2 percentage points above the optimum moisture content until final compaction.

DRILLED PIERS

Each drilled pier excavation must be examined by a representative who is familiar with the geotechnical aspects of the soil stratigraphy, the structural configuration, foundation design details and assumptions, prior to placing concrete. This is to observe that:

- The shaft and/or bell has been excavated to the specified dimensions at the correct depth established by the previously mentioned criteria;
- The bell is concentric with the pier shaft;
- The shaft has been drilled plumb within specified tolerances along its total length; and
- Excessive cuttings, buildup and soft, compressible materials have been removed from the bottom of the excavation.

Based on visual observations and the results of classification tests, the clays are very sandy. This may result in sloughing within the bell at the time of construction. As previously recommended, the bell-to-shaft diameter ratio should not exceed 2 to improve constructability of the underreams in these sandy clays.

Test Pier

We recommend that a test pier be installed outside the building footprints to determine if the pier bells will remain stable during production. The test pier holes could then be backfilled with the soils excavated from the augered holes or with a lean grout or cement stabilized sand.

Reinforcement and Concrete Placement

Reinforcing steel should be checked for size and placement prior to concrete placement. Placement of concrete should be accomplished as soon as possible after excavation to reduce changes in the moisture content or the state of stress of the foundation materials. No foundation element should be left open overnight without concreting.

Temporary Casing

The sandy clays may be prone to caving. Side sloughing and/or groundwater seepage may be encountered at the time of construction of the drilled piers. Therefore, we recommend that the bid documents require the foundation contractor to specify unit costs for temporary casing and/or slurry drilling during installation of drilled piers.

EXCAVATION SLOPING AND BENCHING

If utility trenches or other excavations extend to or below a depth of 5-ft below construction grade, the contractor or others shall be required to develop a trench safety plan to protect personnel entering the trench or trench vicinity. The collection of specific geotechnical data and the development of such a plan, which could include designs for sloping and benching or various types of temporary shoring, are beyond the scope of the current study. Any such designs and safety plans shall be developed in accordance with current Occupational Safety and Health Administration (OSHA) trench safety guidelines (29 CFR 1926 Subpart P Appendix A) and other applicable industry standards.

EXCAVATION EQUIPMENT

Our boring logs are not intended for use in determining construction means and methods and may therefore be misleading if used for that purpose. We recommend that earthwork and utility contractors interested in bidding on the work perform their own tests in the form of test pits or test piers to determine the quantities of the different materials to be excavated, as well as the preferred excavation methods and equipment for this site.

UTILITIES

Utilities which project through slab-on-grade, slab-on-fill, or any other rigid unit should be designed with either some degree of flexibility or with sleeves. Such design features will help reduce the risk of damage to the utility lines as vertical movements occur. These types of slabs will generally be constructed as monolithic, grid-type beam and slab foundations.

Our experience indicates that significant settlement of backfill can occur in utility trenches, particularly when trenches are deep, when backfill materials are placed in thick lifts with insufficient compaction, and when water can access and infiltrate the trench backfill materials. The potential for water to access the backfill is increased where water can infiltrate flexible base materials due to insufficient penetration of curbs, and at sites where geological features can influence water migration into utility trenches.

To reduce the potential for settlement in utility trenches, we recommend that consideration be given to the following:

- Backfill materials should be placed and compacted in controlled lifts appropriate for the type of backfill and the type of compaction equipment being utilized and backfilling procedures should be tested and documented.

- Curbs should completely penetrate flexible base materials and be installed to a sufficient depth to reduce water infiltration beneath the curbs into the pavement base materials.

AREA FLATWORK

It should be noted that ground-supported flatwork such as walkways, driveways, courtyards, sidewalks, etc., will be subject to the same magnitude of potential soil-related movements as discussed previously (see the *Foundation Analysis* section of this report) for this site. Thus, where these types of elements abut rigid building foundations or isolated/suspended structures, differential movements should be anticipated. As a minimum, we recommend that flexible joints be provided where such elements abut main structures to allow for differential movement at these locations. Where the potential for differential movement is objectionable, it may be beneficial to consider methods of reducing anticipated movements or to consider structurally suspending critical areas to match the adjacent building's performance.

PAVEMENT RECOMMENDATIONS

We have developed pavement thicknesses and construction recommendations based on the project design requirements, the pavement design parameters developed from the shallow 10-ft project Boring B-8, and our experience with similar subgrade soils. Pavement design criteria and pavement design parameters for rigid pavement are listed below.

RIGID PAVEMENT

Concrete pavement design for parking lots was performed in accordance with the American Concrete Institute (ACI) *Guide for Design and Construction of Concrete Parking Lots* (ACI Committee 330R-01). Based on an effective modulus of subgrade reaction (k) value of 100 pci (8-inch deep treated subgrade), a concrete flexural strength of 500 psi, and the concrete thickness tables presented in Table 2.4 of ACI 330R, design concrete thicknesses for light duty, medium duty, and heavy duty pavement are presented below.

- Light Duty Pavement (Car Parking Areas, Traffic Category A, ADTT = 0), concrete design thickness = 5 inches
- Medium Duty Pavement (Drive Aisles, Traffic Category A-1, ADTT = 10), concrete thickness = 6 inches
- Heavy Duty Pavement (Driveways, Dumpster Areas and Truck Docks, Traffic Category B, ADTT = 25), concrete design thickness = 7 inches

ADTT = Average Daily Truck Traffic. Trucks are defined as vehicles with at least six wheels; excludes panel trucks, pickup trucks, and other four-wheel vehicles.

Using the previously referenced modulus of subgrade reaction value and the foregoing traffic volumes, the following rigid pavement reinforcement is recommended.

Maximum Individual Slab Dimension (Expansion Joint to Crack Control Joint)	= 12.5 feet by 12.5 feet (light duty)
Maximum Individual Slab Dimension (Expansion Joint to Crack Control Joint)	= 15 feet by 15 feet (heavy duty)

Reinforcement Size	= No. 3 Deformed Bars
Reinforcement Spacing	= 18 inches on-centers each way
Load Transfer at Joints, Dowel Size	= 3/4-inch diameter smooth bars
Load Transfer at Joints, Dowel Length	= 16 inches (one end treated to slip)
Load Transfer at Joints, Dowel Spacing	= 12 inches on-centers along each joint

Traffic conditions are expected to vary at the site, with heavy traffic loads anticipated for the entrance drives and lighter traffic loads throughout the parking areas.

PAVEMENT CONSTRUCTION CONSIDERATIONS

SITE PREPARATION

The pavement should be prepared in accordance with the recommendations presented in the *Site Preparation* subsection of the *General Construction Considerations* section of this report.

DRAINAGE CONSIDERATIONS

As with any soil-supported structure, the satisfactory performance of a pavement system is contingent on the provision of adequate surface and subsurface drainage. Insufficient drainage which allows saturation of the pavement subgrade and/or the supporting granular pavement materials will greatly reduce the performance and service life of the pavement systems.

Surface and subsurface drainage considerations crucial to the performance of pavements at this site include (but are not limited to) the following:

- any known natural or man-made subsurface seepage at the site which may occur at sufficiently shallow depths as to influence moisture contents within the subgrade should be intercepted by drainage ditches or below grade drains;
- final site grading should eliminate isolated depressions adjacent to curbs which may allow surface water to pond and infiltrate into the underlying soils. Curbs should be installed to sufficient depth to reduce infiltration of water beneath the curbs, and;
- pavement surfaces should be maintained to help reduce surface ponding and to provide rapid sealing of any developing cracks. These measures will help reduce infiltration of surface water downward through the pavement section.

PORTLAND CEMENT CONCRETE

The PCC used for pavements should be air-entrained to result in a 3.5 percent plus/minus 1 percent air, a slump range of 3 to 5 inches, and a minimum 28-day compressive strength of 3,000 psi. A liquid membrane-forming curing compound should be applied as soon as practical after broom finishing the concrete surface. The curing compound will help reduce the loss of water from the concrete. The reduction in the rapid loss in water will help reduce shrinkage cracking of the concrete.

LIME-FLY ASH TREATMENT OF SUBGRADE

In sandy soils, lime-Fly ash treatment of the subgrade soils should be performed to a depth of 8 in. and be in accordance with the TxDOT Standard Specifications, Item 265. Include fly ash in percentage amounts in lime or lime slurry and apply lime-fly ash in a single mix, single pass over lower PI soils. Complete compaction within 2 hours of commencing compaction and not more than 6 hours after adding and mixing last stabilizing agent. For estimating purposes, we recommend that 3 percent hydrated lime and 7 percent fly ash by dry weight be assumed for treatment. For construction purposes, we recommend that the lime-fly ash content of the subgrade soils be determined by appropriate laboratory testing. The soil-lime-fly ash mixture should be moist-cured a minimum of 3 days before covering with pavement.

The selected Fly-Ash component should be in accordance with ASTM C618, Class C or F; and have a minimum CaO content of 20 percent. Lime-Fly Ash treated subgrade soils should be compacted to a minimum of 95 percent of the maximum dry density as determined by ASTM D698 at a moisture content within the range of optimum moisture content to 3 percentage points above the optimum moisture content.

LIME TREATMENT OF SUBGRADE

In cohesive soils, lime may be used to treat the subgrade soils. Lime treatment of the cohesive subgrade soils should be in accordance with the TxDOT Standard Specifications, Item 260. For estimating purposes, we recommend that 5 percent hydrated lime by dry soil weight be assumed for treatment. Assuming an average dry unit weight of 120 pcf for the pavement subgrade soils (based on the boring logs) and a 8-inch treatment depth, a preliminary application rate of 36 lbs/sy may be used. Prior to construction, we recommend that the optimum lime content of the subgrade soils be determined by appropriate laboratory testing. Lime-treated subgrade soils should be compacted to a minimum of 95 percent of the maximum dry density at a moisture content within the range of optimum moisture content to 3 percentage points above the optimum moisture content as determined by ASTM D698.

Recommendations provided herein include the use of lime treatment as a method to improve pavement subgrade conditions. We also recommend performing additional laboratory testing to determine the concentration of soluble sulfates in the subgrade soils, in order to investigate the potential for a recently reported adverse reaction to lime in certain sulfate-containing soils. The adverse reaction, referred to as sulfate-induced heave, has been known to cause cohesive subgrade soils to swell in short periods of time, resulting in pavement heaving and possible failure.

CONSTRUCTION RELATED SERVICES

CONSTRUCTION MATERIALS TESTING AND OBSERVATION SERVICES

As presented in the attachment to this report, *Important Information About Your Geotechnical Engineering Report*, subsurface conditions can vary across a project site. The conditions described in this report are based on interpolations derived from a limited number of data points. Variations will be encountered during construction, and only the geotechnical design engineer will be able to determine if these conditions are different than those assumed for design.

Construction problems resulting from variations or anomalies in subsurface conditions are among the most prevalent on construction projects and often lead to delays, changes, cost overruns, and disputes. These variations and anomalies can best be addressed if the geotechnical engineer of record, **Raba Kistner**, is retained to perform construction observation and testing services during the construction of the project. This is because:

- **Raba Kistner** has an intimate understanding of the geotechnical engineering report’s findings and recommendations. **Raba Kistner** understands how the report should be interpreted and can provide such interpretations on site, on the CLIENT’s behalf.
- **Raba Kistner** knows what subsurface conditions are anticipated at the site.
- **Raba Kistner** is familiar with the goals of the CLIENT and project design professionals, having worked with them in the development of the geotechnical work scope. This enables **Raba Kistner** to suggest remedial measures (when needed) which help meet the CLIENT’s and the design teams’ requirements.
- **Raba Kistner** has a vested interest in client satisfaction, and thus assigns qualified personnel whose principal concern is client satisfaction. This concern is exhibited by the manner in which contractors’ work is tested, evaluated and reported, and in selection of alternative approaches when such may become necessary.
- **Raba Kistner** cannot be held accountable for problems which result due to misinterpretation of our findings or recommendations when we are not on hand to provide the interpretation which is required.

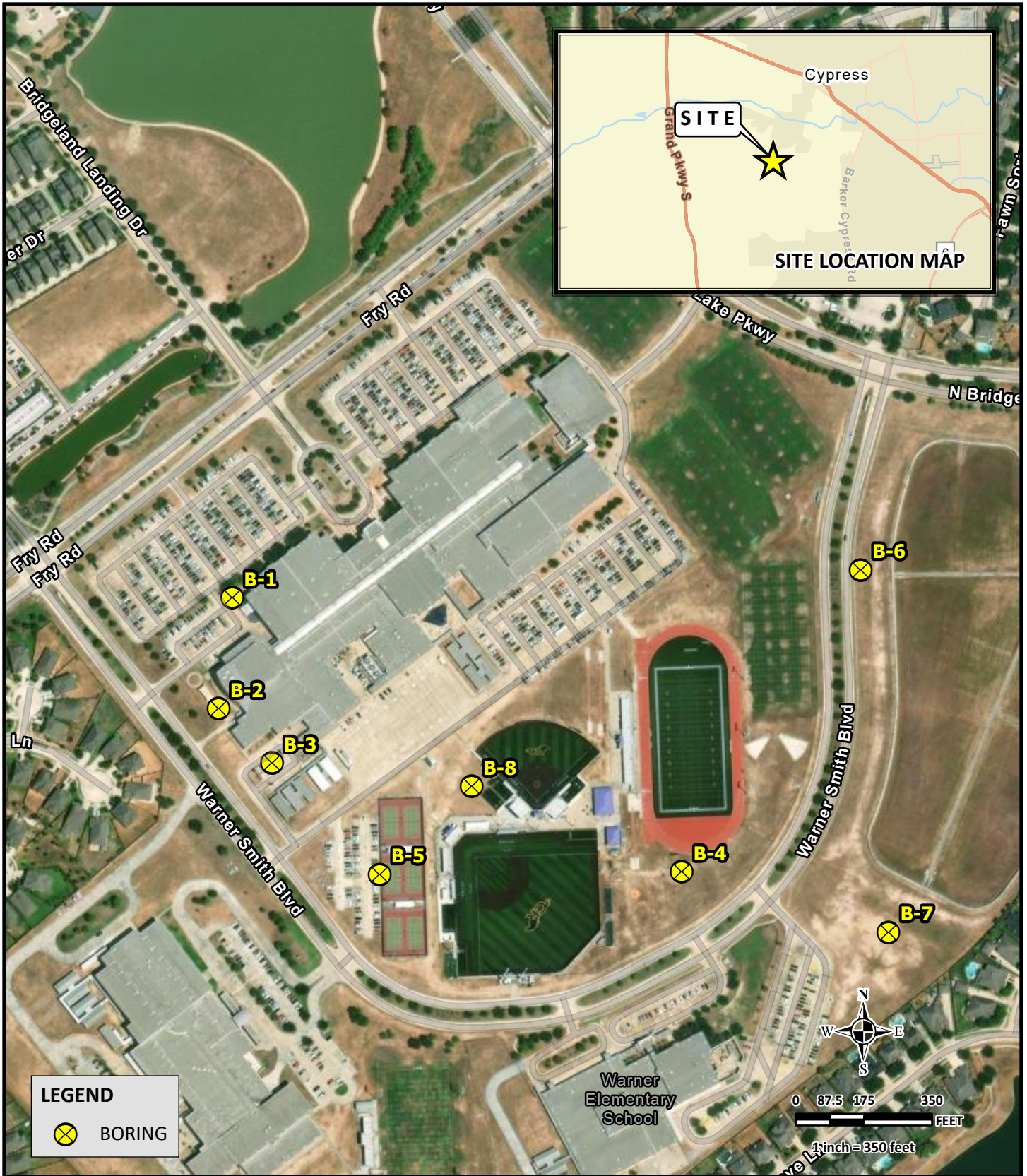
BUDGETING FOR CONSTRUCTION TESTING

Appropriate budgets need to be developed for the required construction testing and observation activities. At the appropriate time before construction, we advise that **Raba Kistner** and the project designers meet and jointly develop the testing budgets, as well as review the testing specifications as it pertains to this project.


Once the construction testing budget and scope of work are finalized, we encourage a preconstruction meeting with the selected contractor to review the scope of work to make sure it is consistent with the construction means and methods proposed by the contractor. **Raba Kistner** looks forward to the opportunity to provide continued support on this project and would welcome the opportunity to meet with the Project Team to develop both a scope and budget for these services.

* * * * *

ATTACHMENTS



LEGEND

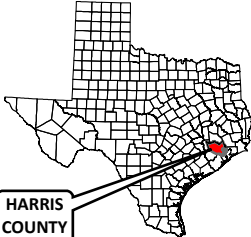
 BORING

SOURCE: Aerial Photograph obtained from Google Earth Pro - 2021

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BORING LOCATION MAP
Cypress Ranch High School (HS)
Additions and Renovations
10700 Fry Road
Cypress, Texas 77433



PROJECT No.:	AHA24-031-00
ISSUE DATE:	6/25/2024
DRAWN BY:	BM
CHECKED BY:	JN
REVIEWED BY:	PTT

FIGURE
1

NOTE: This Drawing is Provided for Illustration Only, May Not be to Scale and is Not Suitable for Design or Construction Purposes

LOG OF BORING NO. B-1

Cypress Ranch High School (HS) Additions and Renovations
10700 Fry Road
Cypress, Texas



DRILLING METHOD: Straight Flight Auger & Mud Rotary

LOCATION: N 29.93930; W 95.72076

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	SHEAR STRENGTH, TONS/FT ²						PLASTICITY INDEX	% -200				
						0.5	1.0	1.5	2.0	2.5	3.0			3.5	4.0		
			SURFACE ELEVATION: 154 ft														
5			CLAYEY SAND (SC), loose to medium dense, light brown and gray	19		●	×	×							10	38	
				23		●											
				14		●	×	×								10	41
				10			●										
				9			●	×	×							19	45
15				14		▼		●									
			POORLY-GRADED SAND w/ SILT (SP-SM), medium dense, light gray	14				●								7	
				12					●								
				19					●								
30			Boring terminated at a depth of about 30 ft.														
35			NOTES: Free water was encountered at a depth of 15 ft during drilling, the water level rose to the 14 ft depth 15 minutes after the initial reading.														
DEPTH DRILLED:			30.0 ft	DEPTH TO WATER:			14 ft	PROJ. No.:			AHA24-031-00						
DATE DRILLED:			6/14/2024	DATE MEASURED:			6/14/2024	FIGURE:			2						

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

LOG OF BORING NO. B-2

Cypress Ranch High School (HS) Additions and Renovations
10700 Fry Road
Cypress, Texas



DRILLING METHOD: Straight Flight Auger & Mud Rotary

LOCATION: N 29.93852; W 95.72090

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	SHEAR STRENGTH, TONS/FT ²						PLASTICITY INDEX	% -200			
						0.5	1.0	1.5	2.0	2.5	3.0			3.5	4.0	
			SURFACE ELEVATION: 154 ft													
0 - 5		X	SANDY LEAN CLAY (CL), very stiff, brown, w/ calcareous nodules	20		●	×	×							8	
5 - 7		X	CLAYEY SAND (SC), loose to medium dense, light tan and brown	13		●										29
7 - 15		X	-w/ ferrous nodules from 6 ft to 8 ft	7		●	×	---	---	×					25	45
15 - 16		X	SILTY SAND (SM), medium dense, light gray and tan	15		●										30
16 - 20		X		15		●										
20 - 25		X	POORLY-GRADED SAND w/ SILT (SP-SM), medium dense, light gray and tan	11		●										10
25 - 30		X		19		●										
30 - 35			Boring terminated at a depth of about 30 ft.													
			NOTES: Free water was encountered at a depth of 17 ft during drilling, the water level rose to the 15.5 ft depth 15 minutes after the initial reading.													

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

DEPTH DRILLED: 30.0 ft	DEPTH TO WATER: 15.5 ft	PROJ. No.: AHA24-031-00
DATE DRILLED: 6/14/2024	DATE MEASURED: 6/14/2024	FIGURE: 3

LOG OF BORING NO. B-3

Cypress Ranch High School (HS) Additions and Renovations
10700 Fry Road
Cypress, Texas



DRILLING METHOD: Straight Flight Auger & Mud Rotary

LOCATION: N 29.93813; W 95.72048

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	SHEAR STRENGTH, TONS/FT ²						PLASTICITY INDEX	%-200	
						0.5	1.0	1.5	2.0	2.5	3.0			3.5
			SURFACE ELEVATION: 153 ft											
			CONCRETE - 5 INCHES	8										
			BASE COURSE - 3 INCHES	8										
			CLAYEY SAND (SC), loose to medium dense, gray and tan	8								13	37	
5				6										
				6										
				117								21	47	
10				11										
				11										
			POORLY-GRADED SAND w/ SILT (SP-SM), medium dense, light gray	13									5	
20				20										
				24										
30			Boring terminated at a depth of about 300 ft.											
			NOTES: Free water was encountered at a depth of 15 ft during drilling, the water level rose to the 13.5 ft depth 15 minutes after the initial reading.											
DEPTH DRILLED: 30.0 ft				DEPTH TO WATER: 13.5 ft				PROJ. No.: AHA24-031-00						
DATE DRILLED: 6/14/2024				DATE MEASURED: 6/14/2024				FIGURE: 4						

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

LOG OF BORING NO. B-4

Cypress Ranch High School (HS) Additions and Renovations
10700 Fry Road
Cypress, Texas



DRILLING METHOD: Straight Flight Auger & Mud Rotary

LOCATION: N 29.93727; W 95.71718

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	SHEAR STRENGTH, TONS/FT ²				PLASTICITY INDEX	% -200			
						0.5	1.0	1.5	2.0			2.5	3.0	3.5
			SURFACE ELEVATION: 151 ft											
17			CLAYEY SAND (SC), loose to medium dense, tan and light gray -w/ silt seams to 2.5 ft	17		●	×	×				11	35	
11				11		●								
14				14		●	×	---	×	●	◇		22	44
13				13		●								
10				10		●								
13				13	▼	▼	●						15	
20			FAT CLAY (CH), firm to very stiff, light gray and reddish brown	9			●	---	---	×		37	93	
25				91		△	◇	●	●					
30							◇	●	●					
			Boring terminated at a depth of about 30 ft.											
			NOTES: Free water was encountered at a depth of 14 ft during drilling, the water level rose to the 13 ft depth 15 minutes after the initial reading.											

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

DEPTH DRILLED: 30.0 ft	DEPTH TO WATER: 13 ft	PROJ. No.: AHA24-031-00
DATE DRILLED: 6/14/2024	DATE MEASURED: 6/14/2024	FIGURE: 5

LOG OF BORING NO. B-5

Cypress Ranch High School (HS) Additions and Renovations
10700 Fry Road
Cypress, Texas



DRILLING METHOD: Straight Flight Auger & Mud Rotary

LOCATION: N 29.93732; W 95.71963

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	SHEAR STRENGTH, TONS/FT ²				PLASTICITY INDEX	% -200	
						0.5	1.0	1.5	2.0			2.5
			SURFACE ELEVATION: 151 ft									
0-5			CONCRETE - 5 INCHES BASE COURSE - 3 INCHES	10								
5-8			SANDY LEAN CLAY (CL), firm to very stiff, dark gray	8							21	59
8-10				120								
10-11			SILTY SAND (SM), medium dense to dense, light gray									
11-15				11								
15-17				17								
17-25				32								
25-25			Boring terminated at a depth of about 25 ft.									
			NOTES: Free water was encountered at a depth of 14 ft during drilling, the water level rose to the 13 ft depth 15 minutes after the initial reading.									
25-30												
30-35												
DEPTH DRILLED: 25.0 ft DATE DRILLED: 6/14/2024			DEPTH TO WATER: 13 ft DATE MEASURED: 6/14/2024			PROJ. No.: AHA24-031-00 FIGURE: 6						

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

LOG OF BORING NO. B-6

Cypress Ranch High School (HS) Additions and Renovations
10700 Fry Road
Cypress, Texas



DRILLING METHOD: Straight Flight Auger & Mud Rotary

LOCATION: N 29.93937; W 95.71566

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	SHEAR STRENGTH, TONS/FT ²							PLASTICITY INDEX	%-200			
						0.5	1.0	1.5	2.0	2.5	3.0	3.5			4.0		
			SURFACE ELEVATION: 152 ft														
5	[Symbol]	[Symbol]	CLAYEY SAND (SC), loose to meditum dense, light brown and gray	7	●												
7				7	●	×	×								12	28	
10				10	●												
6				6	●												
10			SILTY SAND (SM), medium dense to dense, light tan, w/ few gravel	44	●										21		
15			Boring terminated at a depth of about 15 ft.	29	●												
20			NOTES: Free water was encountered at a depth of 14 ft during drilling, the water level rose to the 10.5 ft depth 15 minutes after the initial reading.														
25																	
30																	
35																	

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

DEPTH DRILLED: 15.0 ft DATE DRILLED: 6/17/2024	DEPTH TO WATER: 10.5 ft DATE MEASURED: 6/17/2024	PROJ. No.: AHA24-031-00 FIGURE: 7
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LOG OF BORING NO. B-7

Cypress Ranch High School (HS) Additions and Renovations
10700 Fry Road
Cypress, Texas



DRILLING METHOD: Straight Flight Auger

LOCATION: N 29.93681; W 95.71552

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	SHEAR STRENGTH, TONS/FT ²						PLASTICITY INDEX	% -200
						0.5	1.0	1.5	2.0	2.5	3.0		
			SURFACE ELEVATION: 153 ft										
5	[Symbol]	[Symbol]	CLAYEY SAND (SC), medium dense, tan and light gray, w/ silt seams	20		●	×	--	×			14	35
5	[Symbol]	[Symbol]	SANDY LEAN CLAY (CL), stiff, light brown and gray -w/ ferrous nodules to 8 ft	11		●	×	--	×			27	53
15	[Symbol]	[Symbol]	SILTY SAND (SM), medium dense, light gray and tan	18									19
15	Boring terminated at a depth of about 15 ft.												
	NOTES: Free water was not encountered												

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

DEPTH DRILLED: 15.0 ft DATE DRILLED: 6/17/2024	DEPTH TO WATER: Dry DATE MEASURED: 6/17/2024	PROJ. No.: AHA24-031-00 FIGURE: 8
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LOG OF BORING NO. B-8

Cypress Ranch High School (HS) Additions and Renovations
10700 Fry Road
Cypress, Texas



DRILLING METHOD: Straight Flight Auger

LOCATION: N 29.93792; W 95.71887

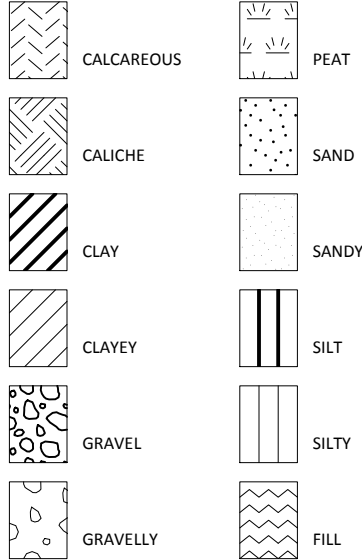
DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	SHEAR STRENGTH, TONS/FT ²						PLASTICITY INDEX	%-200
						0.5	1.0	1.5	2.0	2.5	3.0		
			SURFACE ELEVATION: 151 ft										
5	[Diagonal Hatching]	[X]	SANDY LEAN CLAY (CL), stiff to very stiff, light brown and light gray	25	●							9	56
10	[Diagonal Hatching]	[X]	-w/ ferrous nodules from 6 ft to 10 ft	15	●								
10	[Diagonal Hatching]	[X]	Boring terminated at a depth of about 10 ft.	16	●								
15			NOTES: Free water was not encountered										
20													
25													
30													
35													
DEPTH DRILLED:		10.0 ft		DEPTH TO WATER:		Dry		PROJ. No.:		AHA24-031-00			
DATE DRILLED:		6/17/2024		DATE MEASURED:		6/17/2024		FIGURE:		9			

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

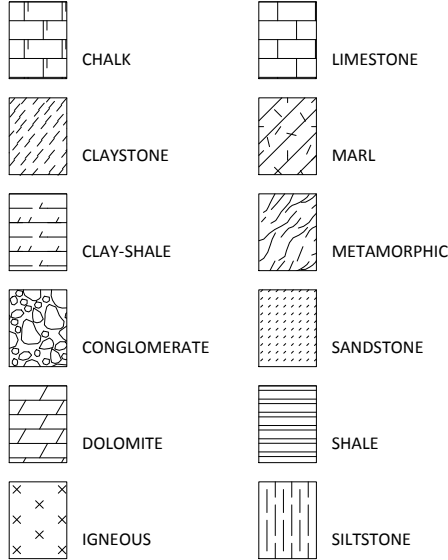
KEY TO TERMS AND SYMBOLS

MATERIAL TYPES

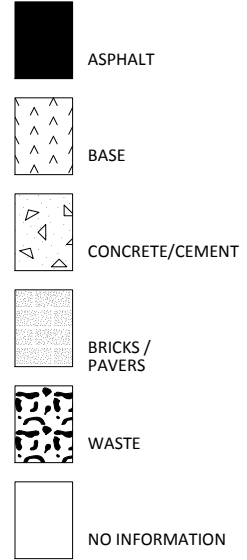
SOIL TERMS



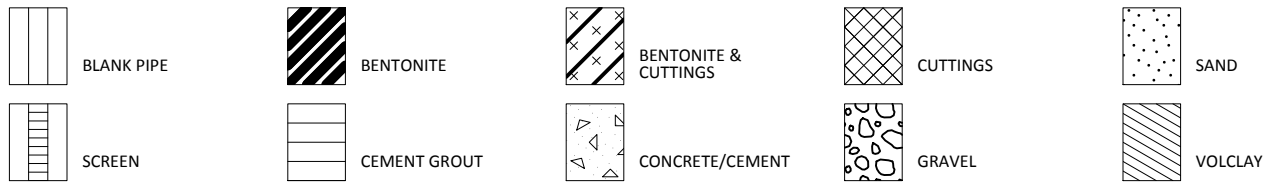
ROCK TERMS



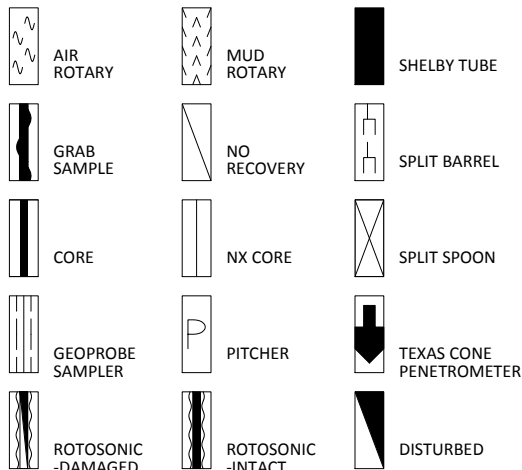
OTHER



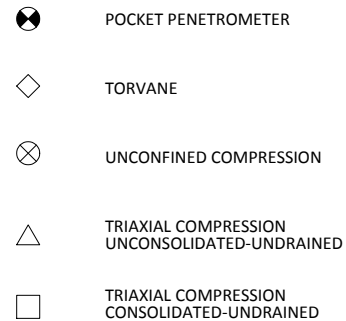
WELL CONSTRUCTION AND PLUGGING MATERIALS



SAMPLE TYPES



STRENGTH TEST TYPES



NOTE: VALUES SYMBOLIZED ON BORING LOGS REPRESENT SHEAR STRENGTHS UNLESS OTHERWISE NOTED

KEY TO TERMS AND SYMBOLS (CONT'D)

TERMINOLOGY

Terms used in this report to describe soils with regard to their consistency or conditions are in general accordance with the discussion presented in Article 45 of SOILS MECHANICS IN ENGINEERING PRACTICE, Terzaghi and Peck, John Wiley & Sons, Inc., 1967, using the most reliable information available from the field and laboratory investigations. Terms used for describing soils according to their texture or grain size distribution are in accordance with the UNIFIED SOIL CLASSIFICATION SYSTEM, as described in American Society for Testing and Materials D2487-06 and D2488-00, Volume 04.08, Soil and Rock; Dimension Stone; Geosynthetics; 2005.

The depths shown on the boring logs are not exact, and have been estimated to the nearest half-foot. Depth measurements may be presented in a manner that implies greater precision in depth measurement, i.e 6.71 meters. The reader should understand and interpret this information only within the stated half-foot tolerance on depth measurements.

RELATIVE DENSITY

COHESIVE STRENGTH

PLASTICITY

<u>Penetration Resistance Blows per ft</u>	<u>Relative Density</u>	<u>Resistance Blows per ft</u>	<u>Consistency</u>	<u>Cohesion TSF</u>	<u>Plasticity Index</u>	<u>Degree of Plasticity</u>
0 - 4	Very Loose	0 - 2	Very Soft	0 - 0.125	0 - 5	None
4 - 10	Loose	2 - 4	Soft	0.125 - 0.25	5 - 10	Low
10 - 30	Medium Dense	4 - 8	Firm	0.25 - 0.5	10 - 20	Moderate
30 - 50	Dense	8 - 15	Stiff	0.5 - 1.0	20 - 40	Plastic
> 50	Very Dense	15 - 30	Very Stiff	1.0 - 2.0	> 40	Highly Plastic
		> 30	Hard	> 2.0		

ABBREVIATIONS

B = Benzene	Qam, Qas, Qal = Quaternary Alluvium	Kef = Eagle Ford Shale
T = Toluene	Qat = Low Terrace Deposits	Kbu = Buda Limestone
E = Ethylbenzene	Qbc = Beaumont Formation	Kdr = Del Rio Clay
X = Total Xylenes	Qt = Fluvial Terrace Deposits	Kft = Fort Terrett Member
BTEX = Total BTEX	Qao = Seymour Formation	Kgt = Georgetown Formation
TPH = Total Petroleum Hydrocarbons	Qle = Leona Formation	Kep = Person Formation
ND = Not Detected	Q-Tu = Uvalde Gravel	Kek = Kainer Formation
NA = Not Analyzed	Ewi = Wilcox Formation	Kes = Escondido Formation
NR = Not Recorded/No Recovery	Emi = Midway Group	Kew = Walnut Formation
OVA = Organic Vapor Analyzer	Mc = Catahoula Formation	Kgr = Glen Rose Formation
ppm = Parts Per Million	EI = Laredo Formation	Kgru = Upper Glen Rose Formation
	Kknm = Navarro Group and Marlbrook Marl	Kgrl = Lower Glen Rose Formation
	Kpg = Pecan Gap Chalk	Kh = Hensell Sand
	Kau = Austin Chalk	

KEY TO TERMS AND SYMBOLS (CONT'D)

TERMINOLOGY

SOIL STRUCTURE

Slicksided	Having planes of weakness that appear slick and glossy.
Fissured	Containing shrinkage or relief cracks, often filled with fine sand or silt; usually more or less vertical.
Pocket	Inclusion of material of different texture that is smaller than the diameter of the sample.
Parting	Inclusion less than 1/8 inch thick extending through the sample.
Seam	Inclusion 1/8 inch to 3 inches thick extending through the sample.
Layer	Inclusion greater than 3 inches thick extending through the sample.
Laminated	Soil sample composed of alternating partings or seams of different soil type.
Interlayered	Soil sample composed of alternating layers of different soil type.
Intermixed	Soil sample composed of pockets of different soil type and layered or laminated structure is not evident.
Calcareous	Having appreciable quantities of carbonate.
Carbonate	Having more than 50% carbonate content.

SAMPLING METHODS

RELATIVELY UNDISTURBED SAMPLING

Cohesive soil samples are to be collected using three-inch thin-walled tubes in general accordance with the Standard Practice for Thin-Walled Tube Sampling of Soils (ASTM D1587) and granular soil samples are to be collected using two-inch split-barrel samplers in general accordance with the Standard Method for Penetration Test and Split-Barrel Sampling of Soils (ASTM D1586). Cohesive soil samples may be extruded on-site when appropriate handling and storage techniques maintain sample integrity and moisture content.

STANDARD PENETRATION TEST (SPT)

A 2-in.-OD, 1-3/8-in.-ID split spoon sampler is driven 1.5 ft into undisturbed soil with a 140-pound hammer free falling 30 in. After the sampler is seated 6 in. into undisturbed soil, the number of blows required to drive the sampler the last 12 in. is the Standard Penetration Resistance or "N" value, which is recorded as blows per foot as described below.

SPLIT-BARREL SAMPLER DRIVING RECORD

<u>Blows Per Foot</u>	<u>Description</u>
25	25 blows drove sampler 12 inches, after initial 6 inches of seating.
50/7"	50 blows drove sampler 7 inches, after initial 6 inches of seating.
Ref/3"	50 blows drove sampler 3 inches during initial 6-inch seating interval.

NOTE: To avoid damage to sampling tools, driving is limited to 50 blows during or after seating interval.

RESULTS OF SOIL SAMPLE ANALYSES

PROJECT NAME: Cypress Ranch High School (HS) Additions and Renovations
 10700 Fry Road
 Cypress, Texas

6/26/2024

Boring No.	Sample Depth (ft)	Blows per ft	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	USCS	Dry Unit Weight (pcf)	% -200 Sieve	Shear Strength (tsf)	Strength Test
B-1	0.5 to 2.0	19	6	24	14	10	SC		38		
	2.5 to 4.0	23	8								
	4.5 to 6.0	14	6	24	14	10	SC		41		
	6.5 to 8.0	10	10								
	8.5 to 10.0	9	10	32	13	19	SC		45		
	13.5 to 15.0	14	16								
	18.5 to 20.0	14	21						7		
	23.5 to 25.0	12	21								
B-2	0.5 to 2.0	20	7	24	16	8					
	2.5 to 4.0	13	10						29		
	4.5 to 6.0	7	14	41	16	25	SC		45		
	6.5 to 8.0	15	12								
	8.0 to 10.0		13							1.00	TV
	13.5 to 15.0	16	13						30		
	18.5 to 20.0	15	23								
	23.5 to 25.0	11	23						10		
B-3	0.5 to 2.0	8	14								
	2.5 to 4.0	8	15	28	15	13	SC		37		
	4.5 to 6.0	6	18								
	6.0 to 8.0		13	34	13	21	SC		47		
	8.0 to 10.0		15					117		1.69	UC
	13.5 to 15.0	11	14								
	18.5 to 20.0	13	21						5		
	23.5 to 25.0	20	21								
B-4	0.5 to 2.0	17	6	25	14	11	SC		35		
	2.5 to 4.0	11	9								
	4.5 to 6.0	14	10	35	13	22	SC		44	2.25	TV
	6.5 to 8.0	13	10								
	8.5 to 10.0	10	15								
	13.5 to 15.0	13	19						15		
	18.5 to 20.0	9	24	59	22	37	CH		93		
	23.0 to 25.0		33					91		0.72	UU
B-5	0.5 to 2.0	10	18								
	2.5 to 4.0	8	16	34	13	21	CL		59		
	4.0 to 6.0		14					120		0.49	UC

PP = Pocket Penetrometer TV = Torvane UC = Unconfined Compression FV = Field Vane UU = Unconsolidated Undrained Triaxial

CU = Consolidated Undrained Triaxial

PROJECT NO. AHA24-031-00

RABAKISTNER

RESULTS OF SOIL SAMPLE ANALYSES

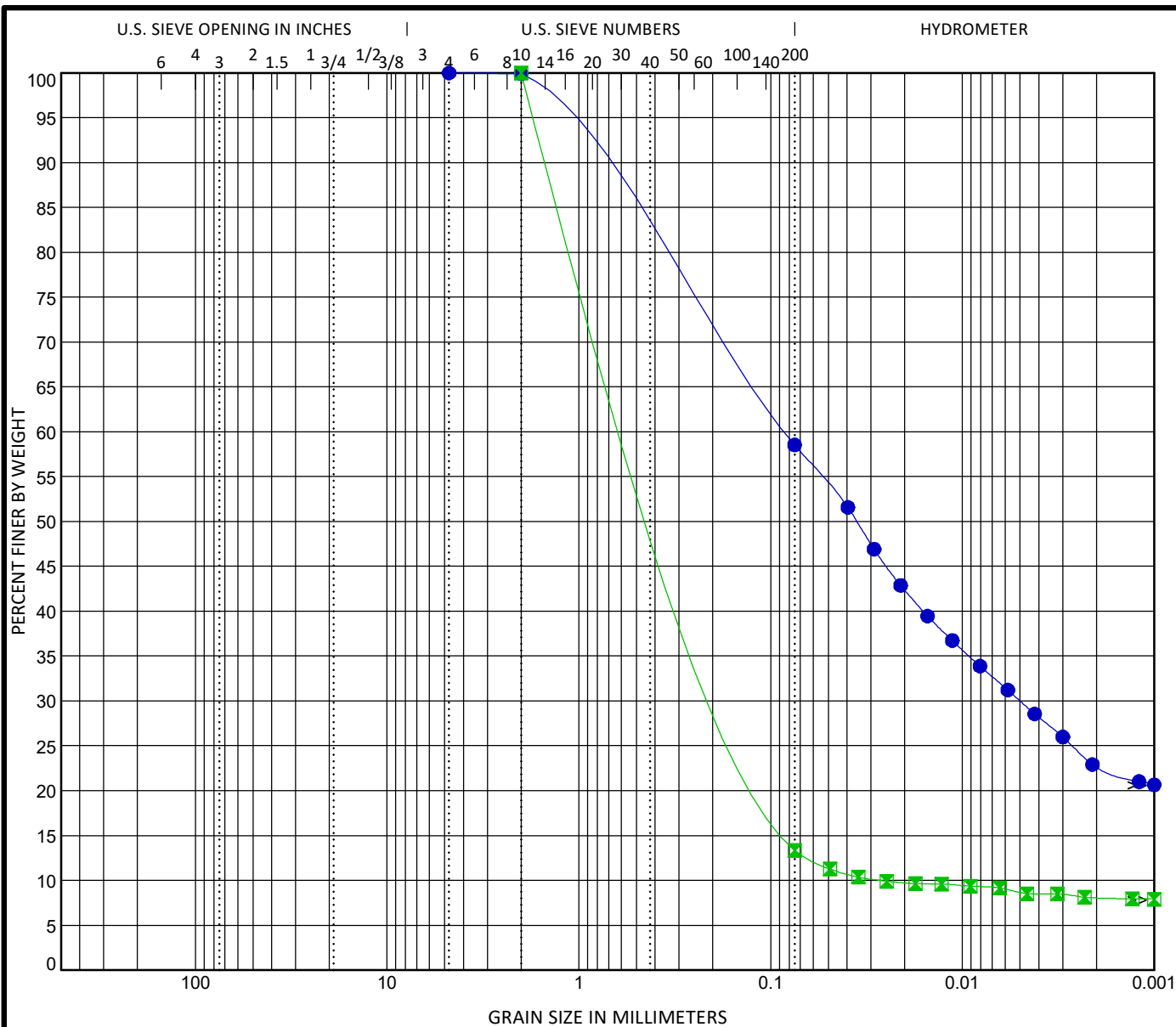
PROJECT NAME: Cypress Ranch High School (HS) Additions and Renovations
 10700 Fry Road
 Cypress, Texas 77433

6/26/2024

Boring No.	Sample Depth (ft)	Blows per ft	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	USCS	Dry Unit Weight (pcf)	% -200 Sieve	Shear Strength (tsf)	Strength Test
B-5	6.0 to 8.0		13	31	14	17	CL		56	1.75	PP
	8.0 to 10.0		15					21			
	13.5 to 15.0	11	22					13			
	18.5 to 20.0	17	22					14			
	23.5 to 25.0	32	20								
B-6	0.5 to 2.0	7	8								
	2.5 to 4.0	7	9	26	14	12	SC		28		
	4.5 to 6.0	10	8								
	6.5 to 8.0	6	13								
	8.5 to 10.0	44	14						21		
	13.5 to 15.0	29	24								
B-7	0.5 to 2.0	20	6	29	15	14	SC		35		
	2.5 to 4.0	19	6								
	4.5 to 6.0	11	13	44	17	27	CL		53		
	6.5 to 8.0	15	8								
	8.5 to 10.0	15	13								
B-8	13.5 to 15.0	18	19						19		
	0.5 to 2.0	25	5								
	2.5 to 4.0	9	10	21	12	9	CL		56		
	4.5 to 6.0	15	11								
	6.0 to 8.0		13							1.25	TV
	8.5 to 10.0	16	13								

PP = Pocket Penetrometer TV = Torvane UC = Unconfined Compression FV = Field Vane UU = Unconsolidated Undrained Triaxial
 CU = Consolidated Undrained Triaxial

PROJECT NO. AHA24-031-00



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification					LL	PL	PI	Cc	Cu
● B-5 2.5	SANDY LEAN CLAY (CL)					34	13	21		
■ B-5 13.5	SILTY SAND (SM)								1.69	16.39
▲										
★										
⊙										

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-5 2.5	4.75	0.084	0.005		0.0	41.5	28.5	30.0
■ B-5 13.5	2	0.439	0.141	0.027	0.0	86.6	4.7	8.7
▲								
★								
⊙								



3602 Westchase
Houston, Texas 77042
(713) 996-8990
(713) 996-8993 fax
www.rkci.com

GRAIN SIZE DISTRIBUTION

Cypress Ranch High School (HS)
Additions and Renovations
10700 Fry Road
Cypress, Texas 77433

R-K GRAIN SIZE AHA24-031-00.GPJ RKCL.GDT 6/25/24

FIGURE 15

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you — should apply this report for any purpose or project except the one originally contemplated.*

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an

assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by:* the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly

problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help

others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold-prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical-engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your GBC-Member geotechnical engineer for more information.



8811 Colesville Road/Suite G106, Silver Spring, MD 20910

Telephone: 301/565-2733 Facsimile: 301/589-2017

e-mail: info@geoprofessional.org www.geoprofessional.org

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DOCUMENT AA

REQUEST FOR COMPETITIVE SEALED PROPOSALS

Competitive Sealed Proposals for the work described below in accordance with Proposal Documents and addenda as may be issued prior to date of proposal opening will be received by the Board of Trustees, Cypress-Fairbanks Independent School District, until proposal closing date and time, as identified below. Proposals from Offerors will then be opened in public and read aloud.

OWNER: Cypress-Fairbanks Independent School District
11440 Matzke Rd.
Cypress, Texas 77429
Representative: Mr. Jesse Clayburn, Assistant Supt. of Facilities and Construction

ARCHITECT: Huckabee, Inc.
1700 City Plaza Dr.
City Place 1, Suite 125
Spring, Texas 77389
281-520-4995

PROJECT: **2024 Cy Ranch HS Renovation**
CFISD Proposal Number: 24-02-5745R-RFP

LOCATION: 10700 Fry Rd.
Cypress, Texas 77433

PROPOSED CONSTRUCTION BUDGET: \$ 16,709,206.00

PRE-PROPOSAL CONFERENCE: **Wednesday, November 20, 2025, at 10:00 AM** at Cypress-Fairbanks Independent School District, Facilities & Construction Conference Room, 11430-B Perry Road, Houston, Texas 77064. Representatives of the Architect and Owner will be present at this meeting. All offerors are encouraged to attend.

PROPOSAL DATE AND TIME: **Tuesday, December 3, 2025,** Base Proposal: 2:00 PM
Alternate Proposal: 3:00 PM

LOCATION OF PROPOSAL OPENING: Cypress-Fairbanks Independent School District
Facilities and Construction
11430-B Perry Road
Houston, Texas 77064
(281) 897-4108

Proposal Documents will be available on **Monday, November 11, 2025**. General Contractor Offerors may obtain two (2) sets of drawings and specifications at the place identified below upon deposit of **\$100.00** per set with check made payable to Huckabee **Architects**. The deposit will be returned when the Plans and Specifications are returned in good condition. Additionally, General Contractor Offerors must submit of a fully executed AIA Document A305, Contractor's Qualification Statement to the office of the Architect at the time proposal documents are obtained.

In addition, proposal documents can be reviewed at the following locations:

ISqFt Plan Room (AGC)
8450 Westpark, Ste. 100
Houston, Texas 77063
Ph: (713) 843-3700 Fx: (713) 843-3701

McGraw-Hill Construction/ Dodge Data & Analytics
www.dodgeplans.construction.com or contact Toni.Lawson@construction.com Ph: (281) 460-5730

Office of **Huckabee Architects**

FULL REFUND: Deposits will be returned provided all Contract Documents and addenda are returned to the Architect complete with all sheets bound in their original order within ten (10) days of the opening of proposals.

FORFEIT OF DEPOSIT: When the Documents are not returned under the conditions specified, none of the deposit will be returned. However, the Documents shall remain the property of the Owner and must be returned.

All proposals must be in the hands of the Owner no later than the time specified above. Please seal all proposals in duplicate in an envelope with the following information on the face of the envelope.

Name of Offeror (General Contractor)
2024 Cy Ranch HS Renovation
Cypress Fairbanks Independent School District
Cypress-Fairbanks I.S.D. Proposal Number: **24-02-5745R-RFP**
_____(Name of Bonding Company)
Attn: Mr. Jesse Clayburn, Assistant Supt. of Facilities and Construction

The Owner reserves the right to reject any and all proposals and to waive any informality in the Competitive Sealed Proposal process. No proposal shall be withdrawn within sixty (60) days after the proposal opening without the specific consent of the Owner. Refer to Offerors Section Document AB.

SELECTION CRITERIA: Selection criteria are included in Document AB of the Project Manual and Selection Criteria and are available on request by perspective Offerors from the office of the Architect.

PROPOSAL BOND: A Proposal Bond from a bonding company acceptable to the Owner or a certified check in an amount equal to 10% of the greatest amount proposed must accompany each offeror's proposal.

PAYMENT BOND AND PERFORMANCE BOND: A Payment Bond and Performance Bond, each in an amount equal to 100% of the Contract Sum conditioned upon the faithful performance of the Contract will be required. Refer to Section AB, Instructions to Offerors for detailed Bond requirements.

The prevailing rates of wages as stipulated in the Supplementary Conditions here within are the minimums that must be paid in conformance with all applicable laws of the State of Texas.

All Offerors (General Contractors) submitting proposals are encouraged to attend the proposal opening and visit the Project site.

Subcontractors and Suppliers intending to submit proposals to General Construction Offerors are required to prepare their proposals based on a complete set of proposal documents. If after reviewing the complete set of proposal documents, Subcontractors and Supplier Offerors desire to purchase individual drawings and specification sections for their proposal convenience, they may do so by ordering the specific drawings and specifications directly from the reproduction company. Each offeror purchasing a partial set of proposal documents is responsible for determining exactly which documents he requires and is responsible for all costs associated with printing and delivery. Subcontractors and Suppliers exercising this option must agree to do so on the basis that 1) all documents shall be returned to the Architect, without refund, after submitting a proposal and 2) documents shall not be used on other construction projects. Successful Subcontractors and Supplier Offerors may retain their Proposal Documents until completion of the construction. The subcontractor/supplier is responsible for all the associated work and coordination when not obtaining a complete set of drawings.

END OF DOCUMENT

DOCUMENT AB

INSTRUCTIONS TO OFFERORS

1. QUALIFIED OFFERORS

- A. Proposals will be accepted from qualified General Contractors only for the entire scope of work described in the Contract Documents. As a prerequisite to a Contractor's qualifying for the award of contract on this work, the Contractor must complete each item of the Contractor Information and Experience Statement (AIA Document A305TM). The Statement forms may be obtained from the office of the Houston Chapter of the American Institute of Architects (A.I.A), 315 Capitol, Suite 120; Houston, TX 77002. The Statement and 3 references of similar projects with current/verified phone numbers, email address and current/verified fax numbers for references of Owner and Architect (refer to Exhibit A on page 9), shall be submitted to the Architect by **5:00P.M. CST on Monday, November 25, 2025**.
- B. Every interested Offeror shall be required to submit AIA Document A305TM (Contractor's Information and Experience Statement) to Architect. AIA Documents submitted by fax transmission will not be accepted.
- C. The primary purposes of the evaluation process will be to:
 1. Gather information for the Owner's evaluation procedure.
 2. Enable the Architect to evaluate the Contractor's qualifications and determine which Contractors the Architect could recommend to the Owner should such recommendation be requested by the Owner.
- D. After completion of the Contractor evaluation process, the Architect will notify the Owner and each Contractor who has submitted a Contractor's Qualification Statement as to the Architect's opinion. In the event the Owner chooses to determine the acceptability of Contractors prior to receipt of Proposals, the Contractors will be notified of the Owner's decision prior to the proposal date, otherwise the Owner will make his decision after receipt of proposals.
- E. In arriving at his opinion concerning the Contractor's qualifications, the Architect will use the same criteria that the Owner will use in determination of the successful Contractor as detailed hereinafter.
- F. In the event an Offeror fails to submit the specified Contractor's Qualification Statement in accordance with the schedule established, such noncompliance shall be considered by both the Owner and Architect as a negative factor in the determination of the successful Offeror.
- G. In the event the Architect notifies a Contractor that it is the Architect's opinion the Contractor has not sufficiently demonstrated his qualifications to perform the subject Contract, taking into consideration the items listed under Paragraph 19.A and the Contractor subsequently decides to submit a Proposal, the Contractor shall be doing so with the knowledge that the Architect will not recommend him as a qualified Offeror.

2. OFFEROR'S PRESENTATION

Each Offeror by making their Proposal represents that:

- A. The Offeror has read and understands the Proposal Documents and their Proposal is made in accordance therewith.
- B. The Offeror has visited the site, has familiarized themselves with the local conditions under which the work is to be performed and has correlated their observations with the requirements of the proposed Contract Documents.

- C. The Offeror agrees to comply with the requirements of the following paragraph. These requirements are absolute, and any Offeror who subsequently does not agree to comply with these requirements will automatically disqualify himself from proposing or receiving award of the contract.

- D. The Offeror agrees that:
 - 1. Work on the project will begin immediately upon the General Contractor's receipt of CFISD's Notice to Proceed. The NTP will be accompanied by CFISD's purchase order.
 - 2. On-site mobilization will not begin until after the Bonds and Certificate of Insurance have been reviewed and approved by the Owner and that timely submittal of correct Bonds and Certificate of Insurance is solely the responsibility of Offeror.
 - 3. Offeror will participate as a team member in cooperation with the Owner and Architect.
 - 4. The Offeror will assign competent full-time superintendents and that these superintendents shall be maintained on the project for the duration of the project including completion of all punch list items, subject only to their continuous employment.
 - 5. The Offeror will furnish and pay for a proposal bond in the amount of ten percent (10%) of the greatest amount proposed.
 - 6. If awarded, the Offeror shall furnish and pay for a Performance Bond and a Payment Bond each in the full contract amount.
 - 7. Offeror and its subcontractors shall comply with requirements listed in Document BD, Insurance and Bonds Requirements for Contractors and Facility Renters.
 - 8. Each Offeror by making their Proposal represents that their Proposal includes only material and equipment specified in the Proposal Documents and supplemented, if necessary, for a complete and operating system.
 - 9. Each Offeror by making their Proposal represents that their Proposal includes the employment of Subcontractors that meet or exceed the Installer Qualifications described in the Project Manual.
 - 10. Each Offeror (and sub-Offeror or supplier submitting a proposal to an Offeror) shall submit an affidavit stating that no asbestos, PCBs or lead building materials will be incorporated into the Work.

3. PROPOSAL DOCUMENTS

- A. Proposal Documents include the Proposal Forms, Contract Forms, Specifications, Drawings, Addenda and documentation as noted in AIA Document A201TM-2017, as amended.

4. INTERPRETATION OF PROPOSAL DOCUMENTS

- A. Offerors and sub-Offerors requiring clarification or interpretation of the Proposal Documents shall make a written request using the form bound in the Project Manual, which shall reach the Architect at least ten (10) days prior to the date for receipt of proposals.
- B. Any interpretation, correction or change of the Proposal Documents will be made by Addendum. Interpretations, corrections or changes of the Proposal Documents made in any other manner will not be binding.

5. SUBSTITUTIONS OF MATERIALS AND EQUIPMENT

- A. The materials, products and equipment described in the Proposal Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution. The materials and equipment named in, and the procedures covered by these specifications have been selected as a standard because of quality, particular suitability or record of satisfactory performance. It is not intended to preclude the use of equal or better materials or equipment provided that same meets the requirements of the particular project and is approved in an addendum as a substitution prior to the submission of proposals.

- B. No substitution will be considered prior to receipt of proposals unless written request for approval has been received by the Architect at least ten (10) days prior to the date for receipt of proposals. Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute including drawings, cuts, performance and test data and any other information necessary for an evaluation. The Architect's decision of approval or disapproval of a proposed substitution shall be final.
- C. If the Architect approves any proposed substitution prior to receipt of proposals, such approval will be set forth in an Addendum. Offerors shall not rely upon approvals made in any other manner.
- D. No substitutions will be considered after the Contract award.

6. ASBESTOS, LEAD AND PCB CONTAINING MATERIALS, PRODUCTS AND SYSTEMS

- A. The use of asbestos or PCB's in any construction process is strictly prohibited
- B. Prior to submitting a proposal, Offerors shall notify the Architect, in writing, of any materials, products and systems in these specifications which are known to contain or are likely to contain asbestos, lead or PCBs. The Architect will promptly explore possibilities for selecting other materials, products and systems which would circumvent the problem and notify Offerors of any changes in an addendum, otherwise it will be understood that only specified materials, products and systems that are asbestos, lead, and PCB free are included in the proposals.
- C. Prior to payment of Retainage and Final Payment, the Contractor and all subcontractors shall furnish a notarized statement certifying that no asbestos/PCB's, or asbestos/PCB-containing materials have been used in this Project.

7. INSURANCE

- A. Each Offeror shall include in his proposal the complete cost for insurance required under the Amended General Conditions, Supplementary Conditions and Specification Document BD, Insurance and Bond Requirements for Contractors and Facility Renters. Coverage shall remain in full force for the duration of the Project.

8. PERFORMANCE BOND AND PAYMENT BOND

- A. Each Offeror shall include in his base proposal, the premium costs for 100% Performance Bond and 100% Payment Bond. Bonds shall be written by a Surety Company included in the latest State Board of Insurance, Bond Department's "List of Insurance Companies Licensed to Write Fidelity and Surety Bonds in Texas, and the latest United States Department of the Treasury's Listing of Approved Sureties (Department Circular 570). The Owner reserves the right to make inquiries about the current financial stability of the Surety, including demands for proof of sound reinsurance, proof that claims are being met, and current financial information. The Owner reserves the right to reject Bonds written by a Surety that, in the Owner's judgment, does not provide proof of sound reinsurance and or does not provide proof that claims are being met.

9. PROPOSAL PROCEDURES

- A. A proposal is invalid if it has not been received at the designated location prior to the time and date for receipt of proposals indicated in the Request for Competitive Sealed Proposals, or prior to any extension thereof issued to the Offerors by Addenda.
- B. All requested Alternates shall be proposed. If no change in the Base Proposal is required, enter "No Change".

- C. Prior to the receipt of Proposals, Addenda will be transmitted to each person or firm recorded by the Architect as having received the proposal documents in accordance with the Request for Competitive Sealed Proposals, and will be available for inspection wherever the proposal documents are available for that purpose.
- D. Proposals must be submitted in duplicate and only on the Proposal Forms included in the Project Manual, in sealed envelopes addressed as follows:

Name of Offeror (General Contractor)
Competitive Sealed proposal for:
2024 Cy Ranch HS Renovation
Cypress-Fairbanks Independent School District
Cypress-Fairbanks ISD Proposal Number: 24-02-5745R-RFP

Name of Bonding Company
Attn: Mr. Jesse Clayburn, Assistant Supt. of Facilities and Construction
Facilities, Planning & Construction
11430-B Perry Road
Houston, Texas 77064

- E. All proposals must be delivered sealed to the above address stipulated in the Request for Competitive Sealed Proposals at or before the time and date set. Proposals will be received at no other place. If Proposal is sent by U.S. Mail, it must be sent Registered Mail.
- F. The Owner reserves the right to reject any Proposal if the evidence submitted by, or investigation of, such Offeror fails to satisfy the Owner that such Offeror is properly qualified to carry out the obligations of the contract and to complete the work therein. Conditional proposals will not be accepted. Award may be made to other than the low-dollar Offeror and given to the one offering the “best value” to the school district, in addition to the purchase price, based on the published selection criteria and on its ranking evaluation.
- G. A proposal may be withdrawn only upon request by the Offeror or his duly authorized representative, provided such written request is received by the Owner at the place designated for receipt of proposals and prior at least forty-eight (48) hours before the time fixed for the opening of proposals. The Proposal Bond will be returned with the proposals if withdrawn in accordance with the above. The withdrawal of a proposal does not prejudice the right of the Offeror to file a new proposal at the time and place stated. No proposal may be withdrawn after the time fixed for the opening of proposals for a period of sixty (60) days.

10. SUBMISSION OF ADDITIONAL PROPOSAL INFORMATION

- A. The Offeror shall submit with his Alternate Proposals:
 - 01 Proposal Form AC Alternates
 - 02 An experience profile (resume) of the proposed superintendent(s) and project manager(s). These experience profiles will be considered by the Selection Committee in the evaluation of the Offeror’s proposal.
 - 03 The firm names of the major subcontractors and/or suppliers requested on the Alternate Proposal Form AF.
 - 04 Signed and Notarized Special Owner Requirements Sections 01 35 23 and 01 35 23.1.
 - 05 An experience profile (resume) of the Offeror, including a list of projects completed of similar size and scope. These experience profiles will be considered by the Selection Committee in the evaluation of the Offeror’s proposal.

11. FELONY CONVICTION NOTIFICATION

- A. Each Offeror shall execute and submit Form AE, Statement of Affirmation within the sealed envelope containing the Base Proposal.

- B. Section 44.034, of the Texas Education Code requires a person or business entity that enters into a contract with a school district must give advance notice to the district if the person or an owner or operator of the business entity has been convicted of a felony. The notice must include a general description of the conduct resulting in the conviction of a felony. Subsection (b) states “a school district may terminate a contract with a person or business entity if the district determines that the person or business entity failed to give notice as required by Subsection (a) or misrepresented the conduct resulting in the conviction. The district must compensate the person or business entity for services performed before the termination of the contract.” Subsection (c) states “this section does not apply to a publicly held corporation”.

12. PROPOSAL EVALUATION WAIVER

- A. Each Offeror shall execute and submit Form AG, Proposal Evaluation Waiver within the sealed envelope containing the Base Proposal.
- B. All Offerors shall agree to waive any claim it has or may have against the Owner, Architect, Engineers, Consultants and their respective employees, arising out of or in connection with the administration, evaluation, or recommendation of any proposal. The Offeror further agrees the Owner reserves the right to waive any requirements under the proposal documents or the Contract Documents, with regards to acceptance or rejection of any proposals, and recommendation or award of the contract.

13. AFFIDAVIT OF NON-DISCRIMINATORY EMPLOYMENT

- A. Each Offeror shall execute and submit Form AH, Affidavit of Non-Discriminatory Employment within the sealed envelope containing the Base Proposal.
- B. All Offerors, Contractor and subcontractors shall agree to refrain from discrimination in terms and conditions of employment to the basis of race, color, religion, sex, or national origin, and agrees to take affirmative action as required by Federal Statutes and Rules and Regulations issued in order to maintain and insure non-discriminatory employment practices.

14. CONFLICT OF INTEREST QUESTIONNAIRE

- A. Each Offeror shall execute an on-line Conflict of Interest Questionnaire and submit Form AN within the sealed envelope containing the Base Proposal.

15. PROPOSAL SECURITY

- A. No proposal will be considered unless it is accompanied by a Certified or Cashier's Check or Proposal Bond executed on the form attached. In either case the amount shall be **not less than ten percent (10%) of the greatest amount proposed (considering alternates, if any)**. The proposal security shall insure the execution of the contract and the furnishing of acceptable Performance Bond, Payment Bond and Certificates of Insurance by the successful Offeror within ten (10) days after notification of award to such Offeror and that this proposal will not be withdrawn within sixty (60) days after date of opening of proposals without the consent of the Owner. Proposal Bond shall be submitted on AIA Document A310TM-2010 or on Form AD included in the Project Manual.
- B. Proposal Security shall be submitted within the sealed envelope containing Alternate Proposals.
- C. Withdrawal of a proposal by an Offeror, or refusal to enter into negotiations and/or acceptance of a contract for construction by an Offeror after the opening of proposals and within and including the sixtieth day after proposals shall subject the Offeror to the forfeiture of his proposal security to the Owner.

16. SUBMISSION OF POST PROPOSAL INFORMATION

- A. Each Offeror shall submit, by **5:00P.M. on Wednesday, December 4, 2025**, following documentation to the office of the Architect. The post proposal information submitted by the Offeror will be considered by the Selection Committee in the evaluation of the Offeror's proposal:
1. A bar-chart construction schedule delineating construction phasing including major construction milestone dates.
 2. A statement describing the Offeror's proposed management concept for the Project.
 3. A statement of all Work to be self-performed by the Offeror.
 4. Complete and fully executed Contractor Qualification Statement Form, AIA Document A305, for each of the subcontractors named on the Offeror's Alternate Proposal Form. Qualification statements must include a listing of past projects performed by the subcontractor that are of similar size and scope to the Project. Past project information must include the names and telephone numbers of the respective Owner's and Architect's representatives for those projects.
 5. Any voluntary Value Engineering items that the proposer would believe to be of interest to the Owner. (This VE list will not be considered part of the evaluation process and is entirely voluntary.)
 6. As part of post proposal negotiations the Owner may desire to discuss a voluntary option that would establish the amount to be added to the owner's contingency allowance as an incentive amount offered by the general contractor and identified sub-contractors for early payments made by the owner to the general contractor on or before the 15th day of each month following the specified billing period. In addition, General Contractor agrees to maintain timely payments to subcontractors upon payment to the general contractor by the owner. This incentive is made to the owner as a lump sum for each trade contract participating, the proposed amount offered is for the duration of the contract and shall be allocated on a percentage complete of total contract value per month per contractor or subcontractor offering the incentive for early payment. The amount of the incentive each month shall be the proposed value by trade for the incentive multiplied by the percentage completed that month of that trade or generals total contract, if the owner makes payment to the general contractor on or before the 15th day of the month following the billing period then the incentive would be recognized as a credit to the owners contingency allowance, if the payment is not made on or before the 15th by the owner then the incentive credit to the Owner that month would not be applied.
- A value for this incentive for the general contractor and the proposed list of subcontractors and values proposed for each that want to participate in this option will be submitted by the highest ranked proposer during post proposal negotiations.
- B. The selected Offeror shall execute Form AL, Certification of Project Compliance, and submit at Project Closeout.
- C. The selected Offeror shall execute and submit Form AP, Certification of Criminal History Record Information within 10 days after receipt of Notice to Proceed and prior to commencement of Work.

17. REJECTION OF PROPOSALS

- A. The Owner shall have the right to reject any or all proposals and to reject a proposal not accompanied by any required proposal security, or by other data required by the Proposal Documents, or to reject a proposal which is in any way incomplete, irregular, or not submitted by the published date and time as specified.

18. EVALUATION OF PROPOSALS

- A. The Owner may discuss proposals with Offerors after the proposal opening, to allow for clarification.

- B. The Owner shall endeavor to prevent non-monetary information from competing proposals being disclosed to other Offerors.
- C. The Owner will, within forty-five (45) days after the proposal opening, evaluate and rank each proposal submitted relative to the selection criteria.
- D. The Owner’s Selection Committee will select the Offeror that offers the best value based on the selection criteria and the Selection Committee’s ranking of the proposals.
- E. The Owner and Architect may discuss options with the selected Offeror for cost reduction and/or other Contract terms. If the Owner is unable to come to terms with the first ranked Offeror, discussions are to terminate and the Owner will proceed to the next ranked Offeror and repeat the process until a contract agreement is reached or all proposals are rejected.

19. DETERMINATION OF SUCCESSFUL RESPONDENT AND AWARD OF CONTRACT

A. In determining the Selected Offeror, the Owner will evaluate the information derived from the Offeror's (Contractor's) Qualification Statement, information received from completed Offeror's reference surveys, direct experience with the Offeror by Selection Committee members, the Offeror's proposal including information requested with the proposals and post proposal information submitted by the Offeror relative to the following Selection Criteria. A maximum of **one hundred twenty (120) points** may be scored to each proposal.

1.	Purchase Price – The purchase price will be scored mathematically as a weighted percentile score utilizing the proposal submitted and the weighted value of the criterion	40
2.	Reputation – Offeror and the Offeror’s goods and services for projects of similar size and scope	10
3.	Quality – Offeror and the Offeror’s goods and services for projects of similar size and scope	10
4.	Completion – Offerors past record of completing projects of similar size and scope on time and within budget	10
5.	Warranty – Offeror’s response to warranty work requests, the quality of the warranty work, and the Offeror’s record of monitoring and reporting back to the Owner on the progress of warranty work	10
6.	Close Out – Offeror’s record of closing out projects expeditiously	10
7.	Project Team – The qualifications of the Offeror’s proposed project manager(s) and project superintendent(s)	10
8.	Subcontractors – The qualifications of the Offeror’s proposed subcontractors	20
	Total:	120

The Selection Committee consisting of Cypress-Fairbanks ISD administrators, architects, consultants and other staff will make an initial evaluation of the proposals. Its recommendation will be considered by the Cypress-Fairbanks ISD Board of Trustees (“Board”). The District reserves the right to review the recommendation with the Asst. Supt. of Facilities & Construction, the Director of Construction Field Services, the Director of Design and Facilities Planning, and the Director of Project Management and others deemed appropriate by the District prior to review by the entire Board. The final decision-making authority on the proposals rests with the full Board. Decision-making authority has not been delegated to any person or entity other than the Board.

20. AWARD OF CONTRACT

- A. The Owner's Selection Committee's recommendation based on an evaluation and ranking of each proposal submitted in relation to the selection criteria will be presented to the Board of Trustees for approval and award of the contract for construction. Presentation of the Selection Committee's recommendation is anticipated to occur during the Board of Trustees' meeting on **January 16, 2025**.
- B. The Owner or the Architect, on behalf of the Owner, will issue a written Notice to Proceed after award of the contract for construction by the Board of Trustees.
- C. The selected Offeror shall submit to the Owner, for review and acceptance, a Performance Bond, a Payment Bond and Certificates of Insurance within ten (10) calendar days after receipt of a written Notice to Proceed.
- D. All Offerors shall hold pricing of all alternates open for consideration and acceptance by the District/Owner as noted on Alternates proposal form.

21. ON SITE MOBILIZATION

- A. The selected Offeror shall not commence on-site work under this Contract until he receives a written confirmation from the Owner approving the Performance Bond, Payment Bond and Certificates of Insurance. Timely submittal of correct Bonds and Certificate of Insurance is solely the responsibility of Offeror. Additional review time by the Owner due to Contractor's failure to do so will not constitute grounds for delay claims.

22. CONTRACT TIME AND LIQUIDATED DAMAGES

- A. Refer to the AIA Document A201TM-2017, as Amended for Contract Time and Liquidated Damages provisions of the Contract.

23. AVAILABILITY OF MATERIALS AND SYSTEMS

- A. A serious effort has been made to select only materials that are asbestos free and systems that are readily available. As far as is known at proposal time all items are either available "off the shelf" or within a relatively short period of time. If during the proposal period, an Offeror becomes aware of an availability or delivery problem with any of the specified systems or materials or if they contain asbestos, he should notify the Architect immediately. The Architect will promptly explore possibilities for selecting other systems or materials which would circumvent the problem and notify Offerors of any changes in an addendum, otherwise it will be understood that only specified systems and materials that are asbestos free are included in the proposals.
- B. Decisions regarding allowance items will endeavor to be made in a timely manner to avoid construction delays.

EXHIBIT A

REFERENCE LISTING FOR Cy-Fair ISD

2024 Cy Ranch HS Renovation

OFFEROR NAME: _____

PROJECT No. 1	
Project Name: _____	Completion Date: _____
Contract Amount: \$ _____	Square Footage: _____
OWNER	ARCHITECT
Contact Name: _____	Contact Name: _____
Phone Number: _____	Phone Number: _____
or Email: _____	or Email: _____

PROJECT No. 2	
Project Name: _____	Completion Date: _____
Contract Amount: \$ _____	Square Footage: _____
OWNER	ARCHITECT
Contact Name: _____	Contact Name: _____
Phone Number: _____	Phone Number: _____
or Email: _____	or Email: _____

PROJECT No. 3	
Project Name: _____	Completion Date: _____
Contract Amount: \$ _____	Square Footage: _____
OWNER	ARCHITECT
Contact Name: _____	Contact Name: _____
Phone Number: _____	Phone Number: _____
or Email: _____	Or Email: _____

END OF SECTION

FORM AC
COMPETITIVE SEALED PROPOSAL FORM - BASE PROPOSAL

2024 CY RANCH HS RENOVATION
Cypress-Fairbanks Independent School District
Cypress-Fairbanks I.S.D. Proposal Number: 24-02-5752R-RFP
Attn: Mr. Jesse Clayburn, Asst. Superintendent of Facilities & Construction

Submitted by: _____

Date: _____ Phone No.: _____

To: Board of Trustees
Cypress-Fairbanks Independent School District
Facilities and Construction
11430-B Perry Road
Houston, Texas 77064

Having examined Proposal and Contract Documents prepared by **Huckabee Architects** dated **November 11, 2024**, and having examined site conditions, the undersigned proposes to furnish all labor, equipment and materials and perform all work for the completion of the above-named project for the sum indicated below.

In submitting his Proposal, the undersigned agrees to the following:

1. Hold Base Proposal open for acceptance sixty (60) days.
2. Accept right of Owner to reject any or all proposals, to waive formalities and to accept proposal which Owner considers most advantageous.
3. Enter into and execute the contract, if awarded, for the Base Proposal and accepted Alternate Proposals.
4. Complete work in accordance with the Contract Documents within the stipulated contract time.
5. By signing, the undersigned affirms that, to the best of his knowledge, the Proposals have been arrived at independently and is submitted without collusion with anyone to obtain information or gain any favoritism that would in any way limit competition or give an unfair advantage over respondents in the award of this proposal.

I. BASE PROPOSAL

A. Undersigned agrees to complete the Work for the lump sum amount of:

_____ Dollars \$ _____
(Amount written in words governs) (Amount in figures)

II. ALLOWANCES

Undersigned certifies that the allowances specified in Section 01 21 00 are included in the Base Proposal and agrees that unexpended balance of allowance sums will revert to Owner in the final settlement of the contract.

III. CONTRACT TIME

By submittal of this proposal, the undersigned stipulates that the Base Proposal includes all costs necessary to attain Substantial Completion of the Work on or before the date stipulated in AIA Document A101™-2017.

THIS PAGE OF PROPOSAL FORM MUST BE SUBMITTED BY 2:00 PM, December 3, 2024
COMPETITIVE SEALED PROPOSAL FORM - BASE PROPOSAL

IV. ADDENDA

Undersigned acknowledges receipt of Addenda Nos. _____ dated
_____, _____.

V. CHANGES IN THE WORK

Undersigned understands that changes in the work shall be performed in accordance with the Supplementary Conditions.

VI. LIQUIDATED DAMAGES

By submittal of this proposal, the undersigned stipulates an agreement that if Substantial Completion of the Work is not attained on or before the date stipulated in AIA Document A101™-2017, the undersigned and his Surety shall be liable for and shall pay the Owner the sums stipulated as Liquidated Damages as defined in AIA Document A201™-2017.

It is understood that the right is reserved by the Owner to reject any or all proposals, or waive any informalities in the proposal process.

Authorized Signature

Printed Name

Title

(Seal, if a Corporation)
State whether Corporation,
Partnership or Individual

Name of Contracting Firm

Address

Telephone

Date

THIS PAGE OF PROPOSAL FORM MUST BE SUBMITTED BY 2:00 PM, December 3, 2024
COMPETITIVE SEALED PROPOSAL FORM - BASE PROPOSAL

FORM AC
COMPETITIVE SEALED PROPOSAL FORM - ALTERNATE PROPOSALS

2024 CY RANCH HS RENOVATION
Cypress-Fairbanks Independent School District
Cypress-Fairbanks I.S.D. Proposal Number: 24-02-5745R-RFP
Attn: Mr. Jesse Clayburn, Asst. Superintendent of Facilities & Construction

Submitted by: _____

Date: _____ Phone No.: _____

To: Board of Trustees
Cypress-Fairbanks Independent School District
Facilities and Construction
11430-B Perry Road
Houston, Texas 77064

Having examined Proposal and Contract Documents prepared by **Huckabee Architects**, dated **November 11, 2024**, and having examined site conditions, the undersigned proposes to furnish all labor, equipment and materials and perform all work for the completion of the above-named project for the sum indicated below.

In submitting his Proposal, the undersigned agrees to the following:

1. Hold Alternate Proposal open for acceptance one hundred twenty (120) days.
2. Accept right of Owner to reject any or all proposals, to waive formalities and to accept proposal which Owner considers most advantageous.
3. Enter into and execute the contract, if awarded, for the Base Proposal and accepted Alternate Proposals.
4. Complete work in accordance with the Contract Documents within the stipulated contract time.
5. By signing, the undersigned affirms that, to the best of his knowledge, the Proposals have been arrived at independently and is submitted without collusion with anyone to obtain information or gain any favoritism that would in any way limit competition or give an unfair advantage over respondents in the award of this proposal.

I. ALTERNATES

If the Owner accepts any or all of the Alternates, the undersigned agrees to modify the Base Proposal as stipulated below:

ADD/DEDUCT _____ Dollars \$ _____
(Amount written in words governs) (Amount in figures)

II. UNIT PRICES

If the Owner accepts any or all of the Alternates, the undersigned agrees to add or subtract the following units of work:

UNIT PRICE 1: ELECTRICAL DUPLEX RECEPTACLE

Provide unit price for a new 20A, 120V duplex electrical receptacle and cover plate, flush mounted in a CMU, metal stud, or demountable wall construction, circuited to an existing electrical panel within 150 feet of the outlet using a branch circuit consisting of 2 #10 AWG and 1 #10 AWG ground in 3/4 inch EMT conduit. All conduits to be concealed in wall construction. Unit price shall include a 20 amp circuit breaker to be installed in existing panel space.

THIS PAGE OF PROPOSAL FORM MUST BE SUBMITTED BY 3:00 PM, December 3, 2024
COMPETITIVE SEALED PROPOSAL FORM - ALTERNATE PROPOSAL

(Add/Deduct) _____ Dollars \$ _____

UNIT PRICE 2: DATA DROP

Provide unit price for a data drop, flush mounted in a CMU, metal stud or demountable wall construction., wired to an IDF/MDF Room. The data drop shall consist of a single gang wall box, cabling wiring device, cover plate, 3/4-inch conduit from outlet to above accessible ceiling, plenum-rated cabling routed above accessible ceiling to the nearest MDF or IDF location within 250 feet of the outlet. Termination and testing to be included in the unit price.

(Add/Deduct) _____ Dollars \$ _____

UNIT PRICE 3: VOICE DROP

Provide unit price for a voice drop, flush mounted in a CMU, metal stud or demountable wall construction., wired to the telecommunications/MDF room. The voice drop shall consist of a single gang wall box, voice jack, cover plate, 3/4-inch conduit from outlet to above accessible ceiling, plenum-rated voice cable routed above accessible ceiling to telecommunication head end equipment. Termination and testing to be included in the unit price.

(Add/Deduct) _____ Dollars \$ _____

UNIT PRICE 4: DATA CABLING TO TEACHER STATION

Provide one data drop, including data jack, faceplate, and CAT 6 cable home run to nearest IDF or MDF data rack. Assume length less than 300 FT. Include J-box and conduit from data outlet to ceiling cavity in this unit price.

(Add/Deduct) _____ Dollars \$ _____

UNIT PRICE 5: 4 1/2" THICK CONCRETE WALK PER SQUARE FOOT

This unit cost shall establish the amount to the contract price for the Contractor to add or deduct 4 1/2" thick concrete walk (minimum 100 SF) per Square Foot.

(Add/Deduct) _____ Dollars \$ _____

UNIT PRICE 6: 7" THICK CONCRETE DRIVE PER SQUARE FOOT

This unit cost shall establish the amount to the contract price for the Contractor to add or deduct 7" thick concrete drive (minimum 100 SF) per Square Foot.

(Add/Deduct) _____ Dollars \$ _____

UNIT PRICE 7: PAINTING

This unit cost shall establish the amount to be added or deducted to the contract price for the Contractor to paint 100 square feet of wall (minimum 400 square feet of wall).

(Add/Deduct) _____ Dollars \$ _____

UNIT PRICE 8: ORNAMENTAL FENCE

This unit cost shall establish the amount to be added or deducted from the contract price for the Contractor to add/deduct ornamental fence.

1. 6 foot high fence \$ _____ / linear foot
2. 6 foot high x 4 foot wide gate \$ _____ / per leaf
3. 6 foot high x 6 foot wide gate \$ _____ / per leaf

(Add/Deduct) _____ Dollars \$ _____

THIS PAGE OF PROPOSAL FORM MUST BE SUBMITTED BY 3:00 PM, December 3, 2024
COMPETITIVE SEALED PROPOSAL FORM - ALTERNATE PROPOSAL

UNIT PRICE 9: SECURITY FILM AND GLAZING

This unit cost shall establish the amount to be added to the contract price to provide and install security film on existing exterior glazing (minimum 200 square feet).

- | | | | |
|----|-------------------------|-----------|-------------|
| 1. | Armouredone 23 Mil Film | \$ _____/ | Square foot |
| 2. | Childgard 3/8" | \$ _____/ | Square foot |
| 3. | Childgard 9/16" | \$ _____/ | Square foot |

(Add/Deduct) _____ Dollars \$ _____

III. CONTRACTOR'S PROJECT TEAM MEMBERS

The undersigned proposes the following project team members (include resumes):

Project Manager _____

Superintendent _____

Asst. Superintendent(s) _____

Project Engineer _____

IV. PROPOSED SUBCONTRACTORS

The undersigned proposes the following subcontractors. Note – Not all trades listed below will apply to every project.

Paving: _____

Abatement: _____

Dampproofing/insulator: _____

Masonry: _____

Roofing: _____

Drywall: _____

Casework: _____

Concrete: _____

Plumbing: _____

Mechanical: _____

Electrical: _____

Fire Alarm: _____

Sprinkler: _____

Low Voltage/Security: _____

Site Utilities: _____

Earthwork/Site Prep: _____

Fencing: _____

Pre-Engineered Metal Building: _____

Glazing: _____

THIS PAGE OF PROPOSAL FORM MUST BE SUBMITTED BY 3:00 PM, December 3, 2024
COMPETITIVE SEALED PROPOSAL FORM - ALTERNATE PROPOSAL

It is understood that the right is reserved by the Owner to reject any or all proposals, or waive any informalities in proposal process.

(Seal, if a Corporation)
State whether Corporation,
Partnership or Individual

Authorized Signature

Printed Name

Title

Name of Contracting Firm

Address

Telephone

Date

END OF FORM

FORM AD

PROPOSAL BOND

KNOW ALL MEN BY THESE PRESENTS, that we _____,
as Principal, and _____, as Surety, are held and firmly
bound unto the Cypress-Fairbanks Independent School District, Harris County, Texas, hereinafter called the Owner, in
the penal sum of _____ Dollars
(\$ _____) lawful money of the United States, for the payment of which sum well and truly to be made, we
bind ourselves, our heirs, executors, administrators and successors jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal has submitted the accompanying
Proposal, dated _____, _____, being for the _____, Cypress-Fairbanks
I.S.D. Proposal Number: **24-02-5745R-RFP** for the Cypress-Fairbanks Independent School District, the kind and extent
of work involved being set forth in detail in the proposed Contract Documents cited herein.

NOW, THEREFORE, if the Principal shall not withdraw the accompanying proposal within 60 days after the date set
for opening thereof, and shall within ten (10) days after the prescribed forms are presented to him for signature, enter into
a written contract with the Owner in accordance with the Proposal as accepted; and give Bond and good and sufficient
surety for the faithful performance and proper fulfillment of such contract including payment of all persons supplying
labor or materials therefor, or in the event of the withdrawal of said proposal within the period specified, or the failure to
enter into such contract and give such bond within the time specified, if the Principal shall pay to the Owner the difference
between the aggregate amount for which the Owner may enter into a contract for the same work with another Respondent;
if the latter amount be in excess of the former, then the above obligation shall be void and of no effect, otherwise to
remain in full force and virtue.

IN WITNESS WHEREOF, the above bonded parties have executed this instrument under their several seals this _____
day of _____, _____, the name and Corporate Seal of each corporate party being
hereto affixed and these presents duly signed by its undersigned representatives, pursuant to authority of its governing
body.

Business Address

Individual Principal: Signature and Printed Name

Business Address

Individual Principal: Signature and Printed Name

ATTEST:

Secretary President

BY: _____

Business Address

Corporate Surety

ATTEST: _____

BY: _____

END OF FORM

NOTE: THIS FORM MUST BE EXECUTED AND SUBMITTED WITH ALTERNATE PROPOSAL.

FORM AE

FELONY CONVICTION NOTIFICATION

Note: The Statement of Affirmation Must Be Notarized

STATEMENT OF AFFIRMATION

“The undersigned affirms that he/she is duly authorized to provide this information by the person(s) or business entity making the proposal, and the information provided below concerning felony convictions has been personally and thoroughly reviewed, and verified, and is, therefore, current, true and accurate to the best of my knowledge.”

Firm’s Name: _____ Address: _____

“a. ___ My firm is a publicly held corporation, therefore, this reporting requirement is not applicable.”

“b. ___ My firm is not owned nor operated by anyone who has been convicted of a felony.”

“c. ___ My firm is owned or operated by the following individual(s) who has/have been convicted of a felony:”

Name of Felon(s)

Details of Conviction(s)

PLEASE CHECK a, b, or c ABOVE AND SIGN BELOW

Offeror’s Printed

Name _____ Position/Title _____

Offeror’s

Signature _____ Date _____

Subscribed and sworn to me on this _____ day of _____, 20__.

Notary Public

My Commission expires _____

NOTE: THIS FORM MUST BE EXECUTED AND SUBMITTED WITH BASE PROPOSAL

END OF FORM

FORM AF

LIST OF SUBCONTRACTORS

PROJECT: 2024 Cy Ranch HS Renovation

ARCHITECT: Huckabee Architects

(Name, address) Cypress-Fairbanks Independent School District
Cy-Fair I.S.D. Proposal Number: **24-02-5745R-RFP**
Houston, Harris County, Texas

TO: (General Contractor)

DATE:

List Subcontractors and others proposed to be employed on the above Project as required by the proposal documents.
(To be filled out by the Contractor and returned to the Architect.)

Work/ Division	Firm	Address	Phone	Fax	e-mail	Representative
-------------------	------	---------	-------	-----	--------	----------------

FORM AG

PROPOSAL EVALUATION WAIVER

By submitting a Proposal, the proposer indicated below agrees to waive any claim it has or may have against the Owner, Architect, Engineers, Consultants and their respective employees, arising out of or in connection with the administration, evaluation, or recommendation of any proposal. The proposer further agrees the Owner reserves the right to waive any requirements under the proposal documents or the Contract Documents, with regards to acceptance or rejection of any proposals, and recommendation or award of the contract.

NOTE: The Statement of Affirmation Must Be Notarized.

STATEMENT OF AFFIRMATION

“The undersigned affirms that he/she is duly authorized to execute this waiver by the person(s) or business entity making the proposal.”

Firm’s Name _____ Address: _____

Proposer’s Printed Name _____ Position/Title _____

Proposer’s Signature _____ Date _____

Subscribed and sworn to me on this _____ day of _____, _____.

Notary Public

My Commission expires _____

NOTE: THIS FORM MUST BE EXECUTED AND SUBMITTED WITH BASE PROPOSAL.

END OF FORM

FORM AH

AFFIDAVIT OF NON-DISCRIMINATORY EMPLOYMENT

STATE OF TEXAS)
)
COUNTY OF HARRIS)

AFFIDAVIT

This Company, Contractor, or Subcontractor agrees to refrain from discrimination in terms and conditions of employment to the basis of race, color, religion, sex, or national origin, and agrees to take affirmative action as required by Federal Statutes and rules and Regulations issued pursuant thereto in order to maintain and insure non-discriminatory employment practices.

SIGNED: _____

DATE: _____

PRINTED NAME: _____

TITLE: _____

COMPANY: _____

The person signing above hereby certifies that he or she is fully authorized and empowered to execute this instrument and to bind the person or entity named hereto and does in fact so execute this instrument.

STATE OF TEXAS

COUNTY OF _____)

Subscribed and sworn before me on this _____ day of _____, _____.

Notary Public

My Commission expires _____

NOTE: THIS FORM MUST BE EXECUTED AND SUBMITTED WITH BASE PROPOSAL

END OF FORM

FORM AI

FORM 1: CONDITIONAL WAIVER FOR PROGRESS PAYMENT

CONDITIONAL WAIVER AND RELEASE ON PROGRESS PAYMENT

Cypress-Fairbanks Independent School District

2024 CY RANCH HS RENOVATION

Cypress-Fairbanks ISD Proposal Number: 24-02-5745R-RFP

On receipt by the signer of this document of a check from _____ (maker of check) in the sum of \$ _____ payable to _____ (payee or payees of check) and when the check has been paid by the bank on which it is drawn, this document becomes effective to release any mechanic's lien right, any right arising from a payment bond that complies with a state or federal statute, any common lay payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer's position that the signer has on the property of **Cypress-Fairbanks Independent School District** (owner) located at _____ (location) to the following extent: _____ (job description).

This release covers a progress payment for all labor, services, equipment, or materials furnished to the property or to _____ (person with whom signer contracted) as indicated in the attached statement(s) or progress payment request(s), except for unpaid retention, pending modifications and changes, or other items furnished.

Before any recipient of this document relies on this document, the recipient should verify evidence of payment to the signer.

The signer warrants that the signer has already paid or will use the funds received from this progress payment to promptly paying full all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project in regard to the attached statement(s) or progress payment request(s).

Date _____

(Company name)

By _____ (Signature)

(Printed/Typed name)

(Title)

SWORN AND SUBSCRIBED before me at _____, this ____ day of _____, 20__.

Notary Public in and for the state of _____.

FORM AI

FORM 2: UNCONDITIONAL WAIVER FOR PROGRESS PAYMENT

UNCONDITIONAL WAIVER AND RELEASE ON PROGRESS PAYMENT

Cypress-Fairbanks Independent School District

2024 CY RANCH HS RENOVATION

Cypress-Fairbanks ISD Proposal Number: 24-02-5745R-RFP

NOTICE: THIS DOCUMENT WAIVES RIGHTS UNCONDITIONALLY AND STATES THAT YOU HAVE BEEN PAID FOR GIVING UP THOSE RIGHTS. IT IS PROHIBITED FOR A PERSON TO REQUIRE YOU TO SIGN THIS DOCUMENT IF YOU HAVE NOT BEEN PAID THE PAYMENT AMOUNT SET FORTH BELOW. IF YOU HAVE NOT BEEN PAID, USE A CONDITIONAL RELEASE FORM.

UNCONDITIONAL WAIVER AND RELEASE ON PROGRESS PAYMENT

The signer of this document has been paid and has received a progress payment in the sum of \$ _____
for all labor, services, equipment, or materials furnished to the property or to _____
(person with whom signer contracted) on the property of Cypress-Fairbanks Independent School District (owner) located at _____
_____ (location) to the following extent: _____ (job description).

The signer therefore waives and releases any mechanic's lien right, any right arising from a payment bond that complies with a state or federal statute, any common law payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer's position that the signer has on the above referenced project to the following extent:

This release covers a progress payment for all labor, services, equipment, or materials furnished to the property or to _____ (person with whom signer contracted) as indicated in the attached statement(s) or progress payment request(s), except for unpaid retention, pending modifications and changes, or other items furnished.

The signer warrants that the signer has already paid or will use the funds received from this progress payment to promptly pay in full all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project in regard to the attached statements(s) or progress payment request(s).

Date _____

_____ (Company name)

By _____ (Signature)

_____ (Printed/Typed name)

_____ (Title)

SWORN AND SUBSCRIBED before me at _____, this ____ day of _____, 20__.

_____ Notary Public in and for the state of _____.

FORM AI

FORM 3: CONDITIONAL WAIVER FOR FINAL PAYMENT

CONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT

Cypress-Fairbanks Independent School District

2024 CY RANCH HS RENOVATION

Cypress-Fairbanks ISD Proposal Number: 24-02-5745R-RFP

On receipt by the signer of this document of a check from _____ (maker of check) in the sum of \$ _____ payable to _____ (payee or payees of check) and when the check has been properly endorsed and has been paid by the bank on which it is drawn, this document becomes effective to release any mechanic's lien right, any right arising from a payment bond that complies with a state or federal statute, any common law payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer's position that the signer has on the property of **Cypress-Fairbanks Independent School District** (owner) located at _____ (location) to the following extent: _____ (job description).

This release covers the final payment to the signer for all labor, services, equipment, or materials furnished to the property or to _____ (person with whom signer contracted), inclusive of all modifications and changes therein.

Before any recipient of this document relies on this document, the recipient should verify evidence of payment to the signer.

The signer warrants that the signer has already paid or will use the funds received from this final payment to promptly pay in full all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project up to the date of this waiver and release.

Date _____

_____ (Company name)

By _____ (Signature)

_____ (Printed/Typed name)

_____ (Title)

SWORN AND SUBSCRIBED before me at _____, this ____ day of _____, 20__.

_____ Notary Public in and for the state of _____.

FORM AI

FORM 4: UNCONDITIONAL WAIVER FOR FINAL PAYMENT

UNCONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT

Cypress-Fairbanks Independent School District

2024 CY RANCH HS RENOVATION

Cypress-Fairbanks ISD Proposal Number: 24-02-5745R-RFP

NOTICE: THIS DOCUMENT WAIVES RIGHTS UNCONDITIONALLY AND STATES THAT YOU HAVE BEEN PAID FOR GIVING UP THOSE RIGHTS. IT IS PROHIBITED FOR A PERSON TO REQUIRE YOU TO SIGN THIS DOCUMENT IF YOU HAVE NOT BEEN PAID THE PAYMENT AMOUNT SET FORTH BELOW. IF YOU HAVE NOT BEEN PAID, USE A CONDITIONAL RELEASE FORM.

UNCONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT

The signer of this document has been paid in full for all labor, services, equipment, or materials furnished to the property or to _____ (person with whom signer contracted) on the property of **Cypress-Fairbanks Independent School District** (owner) located at _____ (location) to the following extent: _____ (job description). The signer therefore waives and releases any mechanic’s lien right, any right arising from a payment bond that complies with a state or federal statute, any common law payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer’s position.

The signer warrants that the signer has already paid or will use the funds received from this final payment to promptly pay in full all of the signer’s laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project up to the date of this waiver and release.

Date _____

_____ (Company name)

By _____ (Signature)

_____ (Printed/Typed name)

_____ (Title)

SWORN AND SUBSCRIBED before me at _____, this ____ day of _____, 20__.

_____ Notary Public in and for the state of _____.

FORM AJ

WARRANTY CERTIFICATE

PROJECT NAME: 2024 Cy Ranch HS Renovation
Cypress-Fairbanks I.S.D. Proposal Number: 24-02-5745R-RFP
Architect's Project Number: 1818-07-01
Address: _____

OWNER NAME: *Cypress-Fairbanks Independent School District*

Phone No. *(281) 897-4108*

_____ Warrants _____
(Name of Company) (Description of Work/Products/ Division Number)

_____ against defective materials, workmanship, machinery, hardware, and equipment. The above-mentioned company agrees to repair or replace such defective items at its own expense for a period of _____ year/s from the Date of Substantial Completion.

FIRM ISSUING WARRANTY: _____ **Phone No.** _____

Address: _____ **City** _____ **State** _____ **Zip** _____

IN WITNESS WHEREOF, the above bonded parties have executed this instrument under their several seals this _____ day of _____, _____, the name and Corporate Seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representatives, pursuant to authority of its governing body.

(Printed Name) (Signature) (Title)

(Seal, if a Corporation)
State whether Corporation,
Partnership or Individual

Subscribed and sworn before me on this _____ day of _____, _____.

Notary Public

My Commission expires _____

FORM AK

AFFIDAVIT OF NON-ASBESTOS, LEAD, AND PCB USE IN PROJECT

Complete this form and return to the Architect upon close-out of the project.

PROJECT NAME: 2024 Cy Ranch HS Renovation

Cypress-Fairbanks I.S.D. Proposal Number: 24-02-5745R-RFP

Architect's Project Numbers: 1818-07-01

OWNER NAME: Cypress-Fairbanks Independent School District

Phone No. (281) 897-4108

Address: 11440 Matzke Rd., Cypress, Texas 77429

The undersigned affirms and certifies that to the best of their knowledge and belief asbestos-, lead-, and PCB- containing materials have not been used or incorporated into the Work and lead or lead bearing materials have not been incorporated into potable water systems, including, but not limited to those water systems for drinking fountains, all sinks, showers, bath tubs, residential and commercial kitchen equipment, ice machines, and hose bibs, as applicable to the project. Lead sheet flashing used in through roof plumbing penetration applications is the only permissible lead-containing material on the Project.

SIGNED: _____

DATE: _____

PRINTED NAME: _____

TITLE: _____

COMPANY: _____

The person signing above hereby certifies that he or she is fully authorized and empowered to execute this instrument and to bind the person or entity named hereto and does in fact so execute this instrument.

STATE OF TEXAS

COUNTY OF _____)

Subscribed and sworn before me on this _____ day of _____, _____.

Notary Public

My Commission expires _____

END OF FORM

CERTIFICATION OF PROJECT COMPLIANCE

Completion of this form is required under the provisions of §61.1036(c)(3)(F) TAC for all public school district construction projects. Instructions for completion of this form can be found on page 2.

1. PROJECT INFORMATION

DISTRICT: Cypress-Fairbanks I.S.D.

Facility: 2024 Cy Ranch HS Renovation

ARCHITECT/ENGINEER: Huckabee, Inc.

Address: 10700 Fry Rd.

CONTRACTOR/CM: TBD

City: Cypress, TX 77433

CONTRACT DATE: TBD

DATE DISTRICT AUTHORIZED PROJECT: 2019 Bond authorized 5/4/19, Phase 6 authorized 11/1/23

BRIEF DESCRIPTION OF PROJECT:

CFISD Project Number: 24-02-5745-R-RFP

Various renovations, program additions, mechanical/electrical/plumbing upgrades and security enhancements to an existing high school.

2. CERTIFICATION OF DESIGN AND CONSTRUCTION

The intent of this document is to assure that the school district has provided to the architect/engineer the required information and the architect/engineer has reviewed the School Facilities Standards as required by the State of Texas, and used his/her reasonable professional judgment and care in the architectural/engineering design and that the contractor has constructed the project in a quality manner in general conformance with the design requirements and that the school district certifies to project completion.

3. The District certifies that the educational program and the educational specifications of this facility along with the identified building code to be used have been provided to the architect/engineer.

DISTRICT: Cypress-Fairbanks I.S.D.

BY: 

DATE: 2/29/2024

4. The Architect/Engineer certifies the above information was received from the school district, and that the building(s) were designed in accordance with the applicable building codes. Further, the facility has been designed to meet or exceed the design criteria relating to space (minimum square footage), educational adequacy, and construction quality as contained in the School Facilities Standards as adopted by the Commissioner of Education, June 9, 2003, and as provided by the district.

ARCHITECT/ENGINEER: Arcadis

BY:

DATE:

5. The Contractor/CM certifies that this project has been constructed in general conformance with the construction documents as prepared by the architect/engineer listed above.

CONTRACTOR/CM: TBD

BY:

DATE:

6. The District certifies completion of the project (as defined by the architect/engineer and contractor).

DISTRICT: Cypress-Fairbanks I.S.D.

BY:

DATE:

INSTRUCTIONS FOR COMPLETION OF “CERTIFICATION OF PROJECT COMPLIANCE” FORM

Section 1. Identify the following:

- name and address of the school facility
- name of the school district
- the Architect/Engineer and Contractor
- the date of execution of the construction contract
- the date that the school district authorized the superintendent to hire an architect/engineer
- scope of the project.

Section 2. This section outlines the intent of the document. No action required.

Section 3. This section is to be executed by the school district upon transmittal of the information (as listed) to the architect/engineer and is to remain in the custody of the school district throughout the entire project.

Section 4. This section is to be executed by the architect/engineer upon completion of the plans and specifications and in conjunction with the completion of the plan review for code compliance (ref. 19 TAC §61.1033 or §61.1036, School Facilities Standards) and returned to the school district’s files.

Section 5. This section is to be executed by the contractor upon substantial completion of the project and retained in the school district’s files.

Section 6. This section is to be executed by the school district upon acceptance and occupancy of the project.

NOTE: DO NOT SUBMIT THIS DOCUMENT TO THE TEXAS EDUCATION AGENCY. The school district will retain this document in their files indefinitely until review and/or submittal is required by representatives of the Texas Education Agency.

FORM AM

REQUEST FOR CLARIFICATION DURING PROPOSAL PROCESS

All clarifications requested during the proposal process must be submitted in written form using the form provided. Fax form to the attention of Architect. All pertinent responses to clarification requests will be made by addenda to the Contract Documents.

PROJECT: _____

CONTRACTOR: _____

SUBMITTED BY: _____

PRINTED NAME: _____

TITLE: _____

TELEPHONE: _____

FAX: _____

EMAIL: _____

CLARIFICATION REQUESTED	ARCHITECT USE
--------------------------------	----------------------

END OF FORM

SECTION AN

Conflict of Interest Questionnaire

According to Local Government Code, Chapter 176, a person or an agent of a person who contracts or seeks to contract for the sale or purchase of property, goods, or services with Cypress-Fairbanks Independent School District must file a completed Conflict of Interest Questionnaire with the Purchasing Department not later than the seventh business day after the date that the person begins contract discussions or negotiations with the District or submits to the District an application, response to a request for proposals or bids, correspondence, or another writing related to a potential agreement with the District.

Each Proposer must complete the on-line version of the Conflict Of Interest Questionnaire at the following website:

<https://app.cfsd.net/ciq/index.aspx>

Full instructions for completing the Questionnaire are included at this website.

CERTIFICATION OF PROPOSER'S COMPLETION OF CONFLICT OF INTEREST QUESTIONNAIRE

The undersigned certifies that he has completed the Conflict of Interest Questionnaire per the above information.

Authorized Signature

Printed Name

Title

(Seal, if a Corporation)
State whether Corporation,
Partnership or Individual

Name of Contracting Firm

Address

Telephone

Date

TO BE INITIALED BY ARCHITECT AND CONTRACTOR PRIOR TO OWNER'S FINAL CLOSEOUT REVIEW

PROJECT NAME:

NOTE: SUBMIT ALL DOCUMENTS RELATED TO SUBCONTRACTORS AND SUPPLIERS IN ALPHABETICAL ORDER BY NAME OF COMPANY UNLESS NOTED OTHERWISE

	<u>Contractor's Initials</u>	<u>Architect's Initials</u>	<u>CFISD PM Initials</u>
CFISD Close Out Log - with Subcontractors Filled Out	_____	_____	_____
List of Project Team	_____	_____	_____
List of Final Subcontractor/Suppliers/Local Representatives (Form AF)	_____	_____	_____
"Consent of Surety to Final Payment" AIA G707 <input type="checkbox"/> 1. Check for Corporate Seal <input type="checkbox"/> 2. Check for Original Signature <input type="checkbox"/> 3. Check for Project Name	_____	_____	_____
"Contractor's Affidavit of Payment of Debts and Claims" AIA G706 <input type="checkbox"/> 1. Check for Notary <input type="checkbox"/> 2. Check for Original Signature <input type="checkbox"/> 3. Check for Project Name	_____	_____	_____
"Contractor's Affidavit of Release of Liens" AIA G706A <input type="checkbox"/> 1. Check for Notary <input type="checkbox"/> 2. Check for Original Signature <input type="checkbox"/> 3. Check for Project Name	_____	_____	_____
Subcontractors' Waiver of Lien (Subcontractors/Major Suppliers) (Conditional or Unconditional) (Form AI) <input type="checkbox"/> 1. Check against Subcontractor List <input type="checkbox"/> 2. Check for Notary <input type="checkbox"/> 3. Check for Original Signature <input type="checkbox"/> 4. Check for Project Name	_____	_____	_____
"Certificate of Substantial Completion" AIA G704	_____	_____	_____
Allowances <input type="checkbox"/> 1. <i>CPR Execution Complete (Owner)</i> <input type="checkbox"/> 2. <i>Account Balance Review (Owner)</i> <input type="checkbox"/> 3. Executed Final Change Order	_____	_____	_____
Architect letter confirming all punch list items complete (Architect) <input type="checkbox"/> 1. Final Signed Off Punch list	_____	_____	_____
List of All Permits during Job and a Copy of All Permits	_____	_____	_____
Storm Water Quality Permit (As-Built Certificate) <input type="checkbox"/> 1. Check for Original Signature <input type="checkbox"/> 2. Check for Project Name <input type="checkbox"/> 3. Check for Permit Number <input type="checkbox"/> 4. Check for Engineer License Seal	_____	_____	_____

PROJECT CLOSE OUT – FORM AO

	<u>Contractor's Initials</u>	<u>Architect's Initials</u>	<u>CFISD PM Initials</u>
Utilities (Owner)	_____	_____	_____
<input type="checkbox"/> Invoice/Check for Electricity			
<input type="checkbox"/> Invoice/Check for Gas			
<input type="checkbox"/> Invoice/Check for Water/Sewer/Irrigation			
Contractor's Overtime	_____	_____	_____
<input type="checkbox"/> Invoices Sent to Contractor (Owner)			
<input type="checkbox"/> Payment Received by Contractor (Owner)			
Copy of Certificate of Compliance/Occupancy from local governmental Authorities	_____	_____	_____
Project Compliance Certificate (Owner Form AL)	_____	_____	_____
<input type="checkbox"/> 1. Check for Original Signature			
<input type="checkbox"/> 2. Check for Project Name			
Hazardous Material Certificate (Architect, General Contractor/Contractor, Subcontractors, and Material/Equipment Suppliers) Each shall be notarized. (Form AK)	_____	_____	_____
<input type="checkbox"/> 1. Check against Subcontractor List			
<input type="checkbox"/> 2. Check for Notary			
<input type="checkbox"/> 3. Check for Project Name			
<input type="checkbox"/> 4. Check for Original Signature			
Asbestos Manifest	_____	_____	_____
<input type="checkbox"/> Signed by all appropriate parties			
Report from Asbestos Consultant confirming abatement observations and air monitoring	_____	_____	_____
<input type="checkbox"/> 1. Asbestos Reports			
<input type="checkbox"/> 2. <i>Transmit Originals to Maintenance, Keep Copies for File. (Owner)</i>			
Letter from Building Envelope Consultant confirming all deficiency items complete	_____	_____	_____
Roofing Warranty & Documentation	_____	_____	_____
<input type="checkbox"/> <i>Send Copies to Director of Maintenance (Owner)</i>			
<input type="checkbox"/> Compliance letter on Roofing from Roofing Consultant			
<input type="checkbox"/> Roofing Manufacturer Letter confirming Warranty			
<input type="checkbox"/> Copy to Roof Warranty Binder (Owner)			
<input type="checkbox"/> Place Original in Roof Warranties Binder (Owner)			
TDLR Inspection	_____	_____	_____
<input type="checkbox"/> Inspection Report			
<input type="checkbox"/> Deficiencies documented and corrected (if applicable)			
<input type="checkbox"/> Approval letter from TDLR			
Letter from Test & Balance Consultant confirming all deficiency items complete	_____	_____	_____
Letter from Commissioning Consultant confirming all deficiency items complete	_____	_____	_____
Letter from Structural Engineer confirming conformance with design (provided by Architect)	_____	_____	_____
Letter from Civil Engineer confirming conformance with design (provided by Architect)	_____	_____	_____

PROJECT CLOSE OUT – FORM AO

	<u>Contractor's Initials</u>	<u>Architect's Initials</u>	<u>CFISD PM Initials</u>
Letter from Mechanical Engineer confirming conformance with design (provided by Architect)	_____	_____	_____
Letter from Materials Testing Consultant confirming all deficiency items complete	_____	_____	_____
Letter from Consultants confirming conformance with design if applicable (Provided by Consultant, FDP, C-H, etc.)	_____	_____	_____
Copy of all Gas Pipe Test Results Form	_____	_____	_____
Elevators	_____	_____	_____
<input type="checkbox"/> Maintenance Service Agreement			
<input type="checkbox"/> Send Copy to Maintenance (Owner)			
General Contractor's Written Guarantee (Form AJ)	_____	_____	_____
<input type="checkbox"/> 1. Check for Notary			
<input type="checkbox"/> 2. Check for Original Signature			
<input type="checkbox"/> 3. Check for Project Name			
Subcontractors' Written Guarantee (Form AJ)	_____	_____	_____
<input type="checkbox"/> 1. Check against Subcontractor List			
<input type="checkbox"/> 2. Check for Original Signature			
<input type="checkbox"/> 3. Check for Project Name			
<input type="checkbox"/> 4. Check for Notary			
<input type="checkbox"/> 5. State date to be date of Substantial Completion of final phase of project			
Extended Warranties & Maintenance List	_____	_____	_____
Insurance Certificate documenting continuing coverage after Final Payment (see AIA Document A201™-2017, as amended, Article 11.1.3)	_____	_____	_____
Workers' Compensation Certificates	_____	_____	_____
<input type="checkbox"/> General Contractor			
<input type="checkbox"/> <u>ALL</u> Subcontractors			
All Extra Stock Transmittals by Division	_____	_____	_____
<input type="checkbox"/> Divisions 0 – 21			
<input type="checkbox"/> Division 22 Plumbing			
<input type="checkbox"/> Division 23 HVAC			
<input type="checkbox"/> Division 26 Electrical			
<input type="checkbox"/> Division 27, 28 and beyond as applicable			
CFISD Master Keys Returned	_____	_____	_____
Paint Mix Cards	_____	_____	_____
List of Finishes used in Project	_____	_____	_____
Demonstration and Training Sign In Sheets by Division with Digital Video if applicable	_____	_____	_____

PROJECT CLOSE OUT – FORM AO

Contractor's Initials Architect's Initials CFISD PM Initials

Maintenance/Operations Manuals (2 hard copies, 1 digital copy)
(Reviewed/Approved by Architect)

- Divisions 0 – 21
- Division 22 Plumbing
- Division 23 HVAC
- Division 26 Electrical
- Division 27, 28 and beyond as applicable

Record Drawings / As-Builts

- 1. Record CAD Files
- 2. Record PDF Files

The undersigned Contractor certifies that to the best of the Contractor’s knowledge, information and belief the close out documentation attached has been accurately completed in accordance with the Contract Documents, and requests permission to submit the FINAL Application and Certification for Payment AIA G702 Document for the outstanding retainage owed under the contract.

Contractor:

By: _____

Print Name: _____

In accordance with the Contract Documents, based on data comprising the attached, the Architect certifies to the Owner that to the best of the Architect’s knowledge, information and belief the Project Close Out Documents have been completed as indicated, the accuracy of the documents is in accordance with the Contract Documents.

Architect:

By: _____

Print Name: _____

CFISD Project Manager Signature: _____ Date: _____

CFISD Director of Project Management Signature: _____ Date: _____

CFISD Director of Contract Management Signature: _____ Date: _____

CFISD Assistant Superintendent Signature: _____ Date: _____

FORM AP – Contractor SB 9 Public Works Contractor Certification

Introduction: Texas Education Code Chapter 22 requires entities that contract with school district contractors to obtain criminal history record information regarding covered employees. Covered employees with disqualifying criminal histories are prohibited from serving at a school district. Contractors must certify to the District that they have complied.

The District may not obtain criminal histories for contractors: The law requires each contractor to obtain the criminal histories of its covered employees.

Definitions:

Covered employees: Employees of a contractor who have or will have continuing duties related to the service to be performed at the District and have or will have the opportunity for direct contact with students in connection with the person's continuing duties. The District will be the final arbiter of what constitutes *continuing duties* or *direct contact* with students. *Disqualifying criminal history:* (1) a conviction or other criminal history information designated by the District or (2) a conviction for one of the following offenses during the preceding 30 years, if at the time of the offense, the victim was under 18 or enrolled in a public school: (a) a felony offense under Title 5, Texas Penal Code; (b) an offense for which a defendant is required to register as a sex offender under Chapter 62, Texas Code of Criminal Procedure; (c) an equivalent offense under federal law or the laws of another state. Title 5 felony offenses include criminal homicide; kidnapping, unlawful restraint, and smuggling of persons; trafficking of persons; sexual offenses; and assaultive offenses.

On behalf of _____ ("Contractor"), I, the undersigned authorized signatory for Contractor, certify to Cypress-Fairbanks Independent School District ("District") and Contractor that [check one]:

None of Contractor's employees are *covered employees*, as defined above. If this box is checked, I further certify that Contractor has taken precautions or imposed conditions to ensure that its employees will not become *covered employees*. Contractor will maintain these precautions or conditions throughout the time the contracted services are provided.

Or

Some or all of Contractor's employees are *covered employees*. If this box is checked, I further certify that:

- 1) Contractor has obtained all required criminal history record information regarding its covered employees. None of the covered employees has a disqualifying criminal history.
- 2) If Contractor receives information that a covered employee subsequently has a reported criminal history, Contractor will immediately remove the covered employee from contract duties and notify the District in writing with 3 business days.
- 3) Upon request, Contractor will provide the District with the name and any other requested information of covered employees so that the District may obtain criminal history record information on the covered employees.

All company employees must have a CFISD badge prior to working on district property.

There is a processing fee of \$7 per badge requested, for which an invoice will be submitted. This fee is a processing fee per individual submitted on the Employee List Form and is charged regardless of whether the individual is approved to receive a badge.

If the District objects to the assignment of a covered employee based on the covered employee's criminal history record information, Contractor agrees to discontinue using that covered employee to provide services at the District.

I also certify to the District on behalf of Contractor that Contractor has obtained certifications from its subcontractors of compliance with Education Code, Chapter 22.

Noncompliance or misrepresentation regarding this certification may be grounds for contract termination.

Signature

Date

Title

Submit completed form to: Cypress-Fairbanks ISD, Facilities & Construction Office: contractor_badges@cfisd.net

Notes

Public works contractor employees must have opportunity for *direct contact with students* in order to be subject to a mandatory criminal history review. Tex. Educ. Code § .08341(b)(2). Direct contact with students is contact that results from activities that provide substantial opportunity for verbal or physical interaction with students and that is not supervised by a certified educator or other professional district employee.

For public works contractor employees, a person does not have the opportunity for direct contact with students if:

- the public work does not involve the construction, alteration, or repair of an instructional facility;
- if the public work involves construction of a *new* instructional facility, the person's duties related to the contracted services will be completed not later than the seventh day before the first date the facility will be used for instructional purposes; *or*
- if the public work involves an existing instructional facility:
 - the public work area contains sanitary facilities and is separated from all areas used by students by a secure barrier fence that is not less than six feet in height; *and*
 - the contractor adopts a policy prohibiting employees, including subcontractor employees, from interacting with students or entering areas used by students, informs employees of the policy, and enforces the policy at the public work area.

"Instructional facility" means real property, an improvement to real property, or a necessary fixture of an improvement to real property that is used predominantly for teaching the curriculum required under Texas Education Code section 28.002.

FORM AP - Subcontractor SB 9 Public Works Contractor Certification

Introduction: Texas Education Code Chapter 22 requires entities that contract with school district contractors to obtain criminal history record information regarding covered employees. Covered employees with disqualifying criminal histories are prohibited from serving at a school district. Subcontractors must certify to the District and to the contractor that they have complied.

The District may not obtain criminal histories for subcontractors: The law requires each subcontractor to obtain the criminal histories of its covered employees.

Definitions:

Covered employees: Employees of a subcontractor who have or will have continuing duties related to the service to be performed at the District and have or will have the opportunity for direct contact with students in connection with the person's continuing duties. The District will be the final arbiter of what constitutes *continuing duties* or *direct contact* with students. *Disqualifying criminal history:* (1) a conviction or other criminal history information designated by the District or (2) a conviction for one of the following offenses during the preceding 30 years, if at the time of the offense, the victim was under 18 or enrolled in a public school: (a) a felony offense under Title 5, Texas Penal Code; (b) an offense for which a defendant is required to register as a sex offender under Chapter 62, Texas Code of Criminal Procedure; (c) an equivalent offense under federal law or the laws of another state. Title 5 felony offenses include criminal homicide; kidnapping, unlawful restraint, and smuggling of persons; trafficking of persons; sexual offenses; and assaultive offenses.

Subcontractor has entered a contract with _____ ("Contractor") to provide services in connection with contract between Cypress-Fairbanks Independent School District ("District") and Contractor. On behalf of _____ ("Subcontractor"), I, the undersigned authorized signatory for Subcontractor, certify to the District and Contractor that [check one]:

None of Subcontractor's employees are *covered employees*, as defined above. If this box is checked, I further certify that Subcontractor has taken precautions or imposed conditions to ensure that its employees will not become *covered employees*. Subcontractor will maintain these precautions or conditions throughout the time the contracted services are provided.

Or

Some or all of Subcontractor's employees are *covered employees*. If this box is checked, I further certify that:

- 1) Subcontractor has obtained all required criminal history record information regarding its covered employees. None of the covered employees has a disqualifying criminal history.
- 2) If Subcontractor receives information that a covered employee subsequently has a reported criminal history, Subcontractor will immediately remove the covered employee from contract duties and notify the District in writing with 3 business days.
- 3) Upon request, Subcontractor will provide the District with the name and any other requested information of covered employees so that the District may obtain criminal history record information on the covered employees.

All company employees must have a CFISD badge prior to working on district property.

There is a processing fee of \$7 per badge requested, for which an invoice will be submitted. This fee is a processing fee per individual submitted on the Employee List Form and is charged regardless of whether the individual is approved to receive a badge.

If the District objects to the assignment of a covered employee based on the covered employee's criminal history record information, Subcontractor agrees to discontinue using that covered employee to provide services at the District.

I also certify to the District and Contractor on behalf of Subcontractor that Subcontractor has obtained certifications from its subcontractors of compliance with Education Code, Chapter 22.

Noncompliance or misrepresentation regarding this certification may be grounds for contract termination.

Signature

Date

Title

Submit completed form to: Cypress-Fairbanks ISD, Facilities & Construction Office: contractor_badges@cfisd.net

Notes

Public work subcontractor employees must have opportunity for *direct contact with students* in order to be subject to a mandatory criminal history review. Tex. Educ. Code § .08341(b)(2). Direct contact with students is contact that results from activities that provide substantial opportunity for verbal or physical interaction with students and that is not supervised by a certified educator or other professional district employee.

For public works subcontractor employees, a person does not have the opportunity for direct contact with students if:

- the public work does not involve the construction, alteration, or repair of an instructional facility;
- if the public work involves construction of a *new* instructional facility, the person's duties related to the contracted services will be completed not later than the seventh day before the first date the facility will be used for instructional purposes; *or*
- if the public work involves an existing instructional facility:
 - the public work area contains sanitary facilities and is separated from all areas used by students by a secure barrier fence that is not less than six feet in height; *and*
 - the contractor adopts a policy prohibiting employees, including subcontractor employees, from interacting with students or entering areas used by students, informs employees of the policy, and enforces the policy at the public work area.

"Instructional facility" means real property, an improvement to real property, or a necessary fixture of an improvement to real property that is used predominantly for teaching the curriculum required under Texas Education Code section 28.002.

FACILITIES PLANNING AND CONSTRUCTION

CERTIFICATE OF FINAL COMPLETION (AQ)

Project Name:	2024 Cy Ranch HS Renovation	Project No.:	24-02-5745R-RFP
Contractor:			
Contract No.:	01818-06-01	Contract Date:	
Architect/Engineer:	Huckabee Architects		
Date of Final Completion:		Time of Final Completion (include Time Zone CT):	

DATE OF FINAL COMPLETION

The work performed under this contract has been inspected and found to be complete. This constitutes the Owner's acceptance for final completion for the **ENTIRE** contract amount. The date of final completion of the project is hereby established as set forth above.

In accordance with the General Conditions and Supplementary Conditions of the contract, this is to confirm the results of the final completion inspection(s). The Contractor has completed the list of items identified on the pre-final and final punch list(s) that the inspection team required corrected or completed before final acceptance of the work in accordance with the contract. Work accepted with incomplete punch list items or failure of the Owner or other parties to identify work that does not comply with the contract documents or is defective in operation or workmanship does not constitute a waiver of the Owner's rights under the contract or relieve the Contractor of its responsibility for performance or warranties.

In accordance with the contract, the date of final completion is that date jointly certified by the Contractor, Architect/Engineer and Owner that the work is completed and the contract is fully satisfied according the contract documents. Completion of all work is a condition precedent to the Contractor's right to receive final payment.

The **CONTRACTOR** has completed/corrected the items identified on all referenced punch list(s) and the requirements of the contract are fully satisfied according to the contract documents.

Project Manager	(Print Name)	(Date)
-----------------	--------------	--------

The **ARCHITECT** agrees that the work noted in this Certificate of Final Completion is completed in accordance with the contract documents.

Project Architect	(Print Name)	(Date)
-------------------	--------------	--------

The **OWNER** accepts the work designated herein to be in accordance with the requirements for final completion, except as provided in the contract documents.

Project Manager	(Print Name)	(Date)
-----------------	--------------	--------

Director of Construction Field Services	(Print Name)	(Date)
---	--------------	--------

Director of Project Management	(Print Name)	(Date)
--------------------------------	--------------	--------

Director of Contract Management	(Print Name)	(Date)
---------------------------------	--------------	--------

Assistant Supt. of Facilities & Construction	(Print Name)	(Date)
--	--------------	--------

Chief Operations Officer	(Print Name)	(Date)
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Associate Supt. of Facilities, Construction & Support Services		
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SECTION AR

DISCLOSURE OF INTERESTED PARTIES

Section 2252.908 of the Texas Government Code requires a business entity that enters into a contract with a school district must submit a disclosure of interested parties (Form 1295) to the school district and state agency and applies to contracts with a value of \$1,000,000.00 or greater and applies to all contracts entered into on or after January 01, 2016.

An example of the Form 1295 is included in this section; however the form shall be required to be filled out online, printed and signed, and submitted with the contract of which it is applicable.

Filing Process:

By January 01, 2016, the Texas Ethics Commission will make available on its website a new filing application that must be used to file Form 1295. A business entity must use the application to enter the required information on Form 1295 and print a copy of the form and a separate certification of filing that will contain a unique certification number. An authorized agent of the business entity must sign the printed copy of the form and have the form notarized. The completed Form 1295 and certification of filing must be filed with the governmental body or state agency with which the business entity is entering into the contract.

The governmental entity or state agency must notify the commission, using the commission's filing application, of the receipt of the filed Form 1295 and certification of filing not later than the 30th day after the date the contract binds all parties to the contract. The commission will post the completed Form 1295 to its website within seven business days after receiving notice from the governmental entity or state agency.

Information regarding how to use the filing application will be available on the Texas Ethics Commissions site by January 01, 2016 at www.ethics.state.tx.us.

CERTIFICATE OF INTERESTED PARTIES			FORM 1295	
Complete Nos. 1 - 4 and 6 if there are interested parties. Complete Nos. 1, 2, 3, 5, and 6 if there are no interested parties.			OFFICE USE ONLY	
1 Name of business entity filing form, and the city, state and country of the business entity's place of business.			Must file online at www.ethics.state.tx.us/File	
2 Name of governmental entity or state agency that is a party to the contract for which the form is being filed.				
3 Provide the identification number used by the governmental entity or state agency to track or identify the contract, and provide a description of the services, goods, or other property to be provided under the contract.				
4		Nature of Interest (check applicable)		
Name of Interested Party	City, State, Country (place of business)	Controlling	Intermediary	
5 Check only if there is NO Interested Party. <input type="checkbox"/>				
6 UNSWORN DECLARATION My name is _____, and my date of birth is _____. My address _____ (street) _____ (city) _____ (state) _____ (zip code) _____ (country). I declare under penalty of perjury that the foregoing is true and correct. Executed in _____ County, State of _____, on the _____ day of _____, 20____. (month) (year)				
_____ Signature of authorized agent of contracting business entity (Declarant)				
ADD ADDITIONAL PAGES AS NECESSARY				

DOCUMENT BA

CONTRACT DOCUMENTS

I. CONSTRUCTION CONTRACT AGREEMENT

- A. The contract for the construction of the project shall be executed by the successful Offeror on the AIA Document A101™-2017, as amended "Standard Form of Agreement between Owner and Contractor." A Notice to Proceed shall be issued 10 days following Board Award.
- B. A sample of this AIA Document A101™-2017, as amended is attached here within.

II. CONDITIONS OF THE CONTRACT

- A. General Conditions:
 - 1. The General Conditions of the Contract for Construction AIA Document A201™-2017, as supplemented and amended herein, constitutes the General Conditions and is hereby specifically made part of the Contract Documents.
- B. Supplementary Conditions:
 - 1. For modifications to the General Conditions of the Contract for Construction AIA Document A201™-2017, as amended refer to Section CB for the Supplementary Conditions.

END OF DOCUMENT



AIA® Document A201® – 2017

General Conditions of the Contract for Construction

for the following PROJECT:

(Name and location or address)

2024 CY RANCH HS RENOVATION
CFISD Project Number: 24-02-5745R-RFP
Architect Project No. 1818-07-01

CAMPUS ADDRESS:

10700 Fry Road
Cypress, Texas 77433

THE OWNER:

(Name, legal status and address)

Cypress-Fairbanks Independent School District
11430-B Perry Road
Houston, Texas 77064
Telephone Number: (281) 897-4108
Fax Number: (281) 897-3806

THE ARCHITECT:

(Name, legal status and address)

Huckabee, Inc.
1700 City Plaza Dr.
City Place 1, Suite 125
Spring, TX 77389
281-520-4995

TABLE OF ARTICLES

- 1 GENERAL PROVISIONS
- 2 OWNER
- 3 CONTRACTOR
- 4 ARCHITECT
- 5 SUBCONTRACTORS
- 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS
- 7 CHANGES IN THE WORK
- 8 TIME
- 9 PAYMENTS AND COMPLETION
- 10 PROTECTION OF PERSONS AND PROPERTY

ADDITIONS AND DELETIONS:

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

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User Notes:

(1634873396)

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- 12 UNCOVERING AND CORRECTION OF WORK
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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor as amended (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract, as amended (General, Supplementary and other Conditions), Performance Bond, Labor and Materials Payment Bond and Proof of Insurance, Contractor's Proposal, Drawings, Specifications, all Addenda issued prior to execution of the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or a Change Proposal Request, or (4) a written order for a minor change in the Work issued by the Architect.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. This agreement, as amended, represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Construction Documents become part of the Contract when accepted by the Owner. All sections of the Project Manual shall be a part of the Contract, including any Proposal signed by the Contractor, and any Request for Proposals for the Project ("RFP"). The Contract may be amended or modified only by a written Modification signed by the Owner. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

It also includes all supplies, skill, supervision, transportation services, storage requirements and other facilities and things necessary, proper or incidental to the carrying out and completion of the terms of the contract and all other items of cost or value needed to produce, construct and fully complete the public work identified by the Contract Documents.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

(Paragraphs deleted)

§ 1.1.7 The Project Manual

The Project Manual is a volume assembled for the Work which may include the bidding or proposal requirements, sample forms, Conditions of the Contract and Specifications.

§ 1.1.8 Addenda

Addenda are written or graphic instruments issued prior to the execution of the Contract which modify or interpret the Proposal Documents, including Drawings and Specifications, by additions, deletions, clarifications or corrections. Addenda will become part of the Contract Documents when the Construction agreement is executed. The successful Contractor and his Subcontractors shall post all addendum items on their sets of Drawings and Specifications.

§ 1.1.9 Approved Equal, Approved Equivalent or Equal

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The terms Approved and Approved Equivalent relate to the substitution of products or systems approved in writing by the Architect. Refer to Paragraph 3.19 Substitution of Products and Systems for procedure which must be followed.

§ 1.1.10 Proposal Documents

Proposal Documents consist of all documents bound into or referenced in the Project Manual, the Drawings, and Addenda related thereto. The Project Manual contains the Proposal Requirements, Sample Forms, Conditions of the Contract, the Specifications, and a list of Drawings, and Schedules, some of which are bound into the Project Manual (Other Drawings and Schedules are bound separately).

§ 1.1.11 Miscellaneous Other Words

The terms "Bids" or "Bidding" mean Competitive Sealed Proposal, which by definition allows the Owner to accept the "best value" for the school district, based on factors other than cost.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

(Paragraph deleted)

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.2.4 Precedence of the Contract Documents

The most recent issued Document takes precedence over the previous issued forms of the same Document. The order of precedence is as follows with the highest authority listed first.

- .1 The Agreement
- .2 The Addenda
- .3 Conditions of the Contract, Drawings and Specifications shall have equal authority. Should these documents disagree in themselves, the Architect will select the appropriate method for performing the work at no additional increase in the Contract Cost.

In the case of an inconsistency between the Drawings and Specifications or within either set of Documents discovered prior to Proposal Time but too late to be clarified by an Addendum, the better quality or greater quantity of work shall be included in the proposal. Clarification of the inconsistency will be accomplished with Contractor after award of the Contract, and if necessary, an appropriate reduction in the Contract will be accomplished by Change Order.

§ 1.2.5 Relation of Specifications and Drawings

The Drawings and Specifications are correlative and have equal authority and priority. Should they disagree in themselves, or with each other, base the proposals on the most expensive combination of quality or quantity of work indicated. The appropriate method of performing the Work, in the event of the above-mentioned disagreements, will be made by the Architect.

§ 1.2.6 Optional Materials, Brands and Processes

When more than one is specified for a particular item of Work, the choice shall be the Contractor's. The final selection of color and pattern will be made by the Architect from the range available within the option selected by the Contractor, unless the item is specified to match a specific color or sample furnished. Where particular items are specified only products of those named manufacturers are acceptable. Certain specified construction and equipment details may not be regularly included as part of the named manufacturer's standard catalog equipment but shall be provided by the manufacturer as required for the proper functioning of the equipment. Reasonable minor variations in equipment are expected and will be acceptable; however, indicated and specified performance and material requirements are minimum, and will be required in addition to standard accessories. The Architect reserves the right to determine the equality of equipment and materials that deviate from any of the indicated and specified requirements.

§ 1.2.7 Standards and Requirements

When the Contract Documents refer to standards, building codes, manufacturers' instructions, or other documents, unless otherwise specified, then the current edition as of the date of execution of the Agreement by the last party to execute said Agreement shall apply. It shall be the responsibility of the Architect to address revisions or amendments to applicable codes or standards which arise after the date of execution of the Agreement and until Final Completion, pursuant to the terms of the Agreement between Owner and Architect. Requirements of public authorities apply as minimum requirements only and do not supersede more stringent specified requirements.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity, the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Execution of Contract Documents

§ 1.5.1 The Contract Documents shall be signed by the Owner and Contractor. If either the Owner or Contractor or both do not sign all the Contract Documents, the Architect shall identify such unsigned Documents upon request.

§ 1.5.2 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements to the Contract Documents. If an approved Contract Document requiring Contractor's signature has not been signed, then the missing signature shall be provided within a reasonable period of time. Failure of Contractor to sign an approved Contract Document after notice and a reasonable opportunity to sign, shall be considered a material breach of the Contract by Contractor.

§ 1.6 Ownership and Use of Drawings, Specifications and Other Instruments of Service

§ 1.6.1 The Drawings, Specifications and other documents, including those in electronic form, prepared by the Architect and the Architect's consultants are Construction Documents through which the Work to be executed by the Contractor is described. All ownership rights, whether common law, statutory, or other reserved rights, including copyright ownership of the Construction Documents, are controlled by the Agreement between the Owner and Architect. The Contractor may retain one record set. Neither the Contractor nor any Subcontractor, Sub-subcontractor or material or equipment supplier shall own or claim a copyright in the Drawings, Specifications and other documents prepared by the Architect or the Architect's consultants. The Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants, and copies thereof furnished to the Contractor, are for use solely with respect to this Project. They are not to be used by the Contractor or any Subcontractor, Sub-subcontractor or material or equipment supplier on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner. The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants appropriate to and for use in the execution of their Work under the Contract Documents. All copies made under this authorization shall bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of any copyrights or other reserved rights.

(Paragraphs deleted)

§ 1.7 Miscellaneous Other Definitions

§ 1.7.1 Alternate Proposal(s)

A separate amount stated on the Proposal Form which, if accepted by the Owner, will be added to or deducted from the Base Proposal. If accepted, the work that corresponds to the alternate proposal will become part of the Agreement between Owner and Contractor. Alternate proposals shall remain valid for a period of 120 days after receipt of proposals, unless otherwise modified, regardless if an Owner Contractor Agreement has been executed, unless indicated otherwise herein.

§ 1.7.2 Base Proposal

The Contractor's proposal for the Work, not including any Alternates.

§ 1.7.3 Contract Time

The period of time which is established in the Contract Documents for Substantial Completion of the Work. This period of time is not subject to adjustment or extension without the written permission of the Owner.

§ 1.7.4 Date of Agreement

The date the Owner formally awards a Contract for Construction of the Work. This date will be inserted on the first page of the Agreement Between Owner and Contractor and shall be referenced in Performance Bond and Payment Bond forms. See also Date of Commencement of the Work.

§ 1.7.5 Date of Commencement of the Work

The commencement date shall be the date the contract award is approved by the CFISD Board of Trustees. This date constitutes day zero ("0") of Contract Time.

§ 1.7.6 Date of Final Completion

The end of construction. Refer to Section 9.10.

§ 1.7.7 Day

The following days are referenced in the documents:

- .1 Calendar Days: The days of the Gregorian Calendar. The Contract Time is established in Calendar Days and extensions of time granted for Regular Work Days lost, in excess of anticipated delay day allowance, will be converted to Calendar Days.
- .2 Holidays: The days officially recognized by the construction industry and/or Owner approved holidays, in this area as a holiday; normally limited to the observance days of New Year's Day, Martin Luther King, Jr. Day, Good Friday, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and the Friday after, Christmas Eve, Christmas Day and New Year's Eve day.
- .3 Regular Work Days: All calendar days except holidays, Saturdays, and Sundays. Requests for extensions of time shall be requested, after expenditure of the Anticipated Delay Day Allowance, on the basis of Regular Work Days, and those days, if approved; will be converted to calendar days by multiplying by a factor of one and four-tenths (1.4). The Contractor is advised to refer to Section 01 35 23.1, Special Owner Requirements regarding after hours use of the premises.
- .4 Anticipated Delay Days Allowance: An allowance of Fifteen (15) Regular Work Days per year (or two (2) regular work days per month, whichever is less) is established as probable days lost due to delays beyond the Contractor's control. This allowance includes District testing dates and any other days the district directs the contractor to not perform work due to unspecified campus events. This additional Delay day allowance does not include anticipated weather days as indicated in section 8.3., also does not include Holidays as indicated in Section 1.7.7.2. These days for weather and holidays are to be added to this additional delay day allowance and are to be calculated in accordance with their respective section as indicated elsewhere in these general conditions to establish the grand total of the anticipated delay day allowance.
- .5 Evaluation of Delay Days: The Architect and Owner will evaluate delays claimed by the Contractor based on the Critical Path of the Contractor's construction schedule, and if the Architect is in agreement that a Critical Path task has been delayed due to circumstances beyond the Contractor's control, the accepted delay days will be deducted from the Anticipated Delay Day Allowance.
- .6 Delay Days: Regular Work Days when circumstances beyond the Contractor's control prevent progress on major portions of the Work as described in Paragraph 8.3, Delays and Extensions of Time, in the General Conditions of the Contract for Construction.

§ 1.7.8 Notice to Proceed

A notice that may be given on behalf of the Owner to the Contractor, through the Architect, that directs the Contractor to start the Work. It also establishes the Date of Commencement of the Work.

§ 1.7.9 Provide

Whenever the word "provide" is used in these documents, it shall mean the same as "furnish and install."

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§ 1.7.10 Punch List

A comprehensive list prepared by the Contractor prior to Substantial Completion to establish all items to be completed or corrected; this list may be supplemented by the Architect or Owner. Refer to Article 9.8.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the independent school district identified in the Contract Documents. The Board of Trustees, by majority vote, is the only representative of the Owner, an independent school district, having the power to: enter into a contract; amend a contract; approve changes in the scope of the Work; approve and execute a Change Order or Construction Change Directive modifying the Contract Sum; agree to an extension to the date of Substantial or Final Completion; or terminate a contract. The Board designates authorized representatives to act on its behalf for day-to-day operations under the Contract. Unless otherwise designated in the Contract Documents, Owner's authorized representative shall be the Superintendent of Schools, who may delegate responsibilities as appropriate. Owner's Board of Trustees hereby delegates to the Superintendent of Schools or designee the authority to approve changes to the Work where such changes are within the Owner's Betterment Allowance or other designated Allowances stipulated in the Contract Documents and also the authority to approve any Change Order which does not exceed \$249,999.99 and the authority to approve any and all time extensions to the Contract. Any Change Order that is valued at or above \$250,000 shall require Board approval in accordance with Local Board Policy. Except as otherwise provided in the Contract Documents, the Architect does not have such authority. Neither Architect nor Contractor may rely upon the direction of any employee of Owner who has not been designated in writing in the Contract Documents. Owner shall not be financially responsible for actions taken by the Architect or Contractor in reliance upon direction from unauthorized persons.

§ 2.1.2 It shall be distinctly understood that by virtue of this Contract, neither the Contractor nor any contractor, subcontractor, sub-subcontractor, consultant, design professional, mechanic, material person, artisan, or laborer, skilled or unskilled, shall ever in any manner have, claim, or acquire any lien upon the buildings or any of the improvements of whatsoever nature or kind so erected or to be erected by virtue of this Contract or upon any of the land on which said buildings or any of the improvements are so erected, built, or situated. It shall be further understood that this Contract is not written for the benefit of third parties nor shall it be construed to create any third party beneficiaries.

§ 2.2 Information and Services Required of the Owner

§ 2.2.1 Prior to commencement of the Work, the Contractor may request in writing that the Owner provide reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. Thereafter, the Contractor may only request such evidence if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) a change in the Work materially changes the Contract Sum; or (3) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due. The Owner shall furnish such evidence as a condition precedent to commencement or continuation of the Work or the portion of the Work affected by a material change. After the Owner furnishes the evidence, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.2 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.2.3 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to reasonably rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work, shall exercise due diligence in attempting to locate underground utilities, and shall notify the Owner and Architect of any discrepancies between the surveys and actual conditions of the site that Contractor observes or should observe in the exercise of ordinary care.

§ 2.2.4 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and

relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.2.5 Refer to Section CB, Supplementary Conditions, for quantities of plans and project specifications to be furnished to the Contractor.

§ 2.3 Owner's Right to Stop the Work

(Paragraphs deleted)

§ 2.3.1 If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.4 Owner's Right to Carry Out the Work

§ 2.4.1 If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within seven (7) Calendar Days after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, immediately correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

§ 2.5 Owner's Right to Occupy the Project

§ 2.5.1 The Owner shall have the right to occupy or use without prejudice to the right of either party, any completed or largely completed portions of the project, notwithstanding the time for completing the entire work or such portions may not have expired. Such occupancy and use shall not constitute acceptance of any work not in accordance with the Contract Documents and Contractor shall be responsible for insurance, utilities and security until Substantial Completion of the entire project.

§ 2.5.2 Refer to Article 11 - Insurance and Bonds regarding property insurance requirements in the event of such occupancy.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents in a good and workmanlike manner and in an expeditious and economical manner consistent with the interest of the Owner; shall exercise the degree of care, skill, and diligence in the performance of the Work in accordance with and consistent with industry standards for similar projects; shall utilize its best skill, effort, and judgment in diligently performing the Work; and shall furnish efficient business administration and supervision. Workmanship shall be of a quality to produce satisfactory results.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 The Contractor shall carefully study and compare the Agreement, Conditions of the Contract, Drawings, Specifications, Addenda, Modifications, and information provided by the Owner and shall at once report to the Architect any error, inconsistency, or omission he may discover. Contractor shall be liable for any damage to Owner for failure to report any error, inconsistency or omission he may discover or should have discovered, but he shall not be liable to Owner or Architect for any damage resulting for such error, inconsistency or omission which he did discover and at once so reported. Contractor shall not perform any work without approved Drawings and Specifications issued by the Architect.

§ 3.2.2 Any design errors or omissions noted by the Contractor during this review shall be reported promptly to the Architect, but it is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional unless otherwise specifically provided in the Contract Documents. The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations, but any nonconformity discovered by or made known to the Contractor shall be reported promptly to the Architect.

§ 3.2.3 If the Contractor believes that additional cost or time is involved because of clarifications or instructions issued by the Architect in response to the Contractor's notices or requests for information pursuant to Sections 3.2.1 and 3.2.2, the Contractor shall make Claims as provided in Sections 4.3.6 and 4.3.7. If the Contractor fails to perform the obligations of Sections 3.2.1 and 3.2.2, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. The Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents or for differences between field measurements or conditions and the Contract Documents unless the Contractor recognized such error, inconsistency, omission or difference and knowingly failed to report it to the Architect.

(Paragraphs deleted)

§ 3.2.4 The Contractor shall take field measurements and verify field conditions and shall carefully compare such fields measurements and conditions and other information known to the Contractor with the Contract documents before commencing activities. Errors, inconsistencies or omissions discovered shall be reported to the Architect at once.

§ 3.2.5 The Contractor shall not be entitled to additional compensation for the "rework portion" of any additional work caused by his failure to carefully study and compare the contract documents prior to execution of the Work.

§ 3.2.6 The Contractor shall make a reasonable attempt to interpret the Contract Documents before asking the Architect for assistance in interpretation. The Contractor shall not ask the Architect for observation of work prior to the Contractor's field superintendent's personal inspection of the work and his determination that the work complies with the Contract Documents. The Contractor shall arrange meetings prior to commencement of the work of all major subcontractors to allow the subcontractor to demonstrate his understanding of the documents to the Architect/Owner and to allow the subcontractor to ask for any interpretation he may require.

§ 3.2.7 If, in the opinion of the architect, the Contractor does not make a reasonable effort to comply with the above requirements of the Contract Documents and this causes the Architect or his Consultants to expend an unreasonable amount of time in the discharge of the duties imposed on him by the Contract Documents, then the Contractor shall bear the cost of compensation for the Architect's additional services made necessary by such failure. The Architect will give the Contractor prior notice of intent to bill for additional services related to above requirements before additional services are performed.

§ 3.2.8 If the Contractor has knowledge that any of the products or systems specified will perform in a manner that will limit the Contractor's ability to satisfactorily perform the work or to honor his Warranty, he shall promptly notify the Architect in writing, providing substantiation for his position. Any necessary changes, including substitution of materials, shall be accomplished by appropriate Modification.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning

construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Contractor shall not be responsible for any resulting loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.3.3.1 The Contractor is especially cautioned to coordinate the routing of all mechanical, plumbing and electrical items and provide coordinating drawings in accordance with provisions of the Contract Documents prior to commencing these operations.

§ 3.3.4 Contractor shall document existing facility conditions and systems onsite prior to performing any work with video recording and/or photographs and shall test said systems to identify any pre-existing deficiencies in the presence of the Owner, Architect/Engineer. Any items not noted or identified in this documentation or brought the attention of the Owner in writing will be assumed to be in working order and any problems with such systems will be the responsibility of the Contractor to correct and repair to the pre-contract condition or better.

§ 3.3.5 Prior to performing any work, the Contractor shall locate all utility lines as shown on the plans and specifications, including telephone company lines and cables, sewer lines, water pipes, gas lines, and electrical lines, and shall perform the Work in such a manner as to avoid damaging any such lines, cables, pipes and pipelines. In addition, the Contractor shall independently determine the location of same.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, eligible to work in accordance with state and federal law. In addition, unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work authorized by the Architect in accordance with Sections 3.12.8 or 7.4, the Contractor may make substitutions only with prior written consent of the Owner, after evaluation by the Architect and in accordance with a Change Order, Construction Change Directive, or Change Proposal Request.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty

(Paragraphs deleted)

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

The Contractor is solely responsible for, and shall provide written proof of maintenance, service, and protection of materials and equipment installed prior to Substantial Completion.

§ 3.5.2 In the event of failure of materials, products, or workmanship, either during construction or the warranty period (as specified in Section 3.5.5), the Contractor shall take appropriate measures to assure correction or replacement of the defective items, whether notified by the Owner or Architect. Items of work first performed after Substantial Completion shall have their warranties extended by the period of time between Substantial Completion and the actual performance of the Work. Such warranties shall be submitted to owner in writing, documenting such time extensions. This warranty period shall not restrict or modify extended warranties called for or provided on systems, equipment or other specific portions of the work.

§ 3.5.3 Contractor shall establish a spreadsheet-type Warranty Work tracking format included in the Project Manual and shall verify and certify completion of each warranty work item.

§ 3.5.4 Approximately six (6) and eleven (11) months after Substantial Completion, the Contractor shall accompany the Owner and Architect on a complete re-inspection of the Project and be responsible for correcting any additional deficiencies observed or reported, including any uncompleted Punch List Items or outstanding or incomplete Warranty Items.

§ 3.5.5 The Warranty Period for this Project is One (1) Year from the date of Substantial Completion except for any extended warranties as specified herewith in the Contract Documents

§ 3.5.6 The warranty period shall extend one (1) year on specific items of work (materials and labor) if warranty work is performed on a specific item or work that requires the issuance of a second warranty work request within ninety (90) days after the original warranty work request was issued.

§ 3.5.7 Warranty work shall be performed within ten (10) working days after the Contractor receives a request for warranty work, except where immediate responses are required as described below:

- .1 For work which is identified as affecting life safety, fire alarm or security of the occupants and/or the facility on the warranty request, on-site corrective work shall begin immediately after receipt of the warranty work request by the Contractor, 365 days per year, twenty-four (24) hours per day.
- .2 For work affecting the operation of the HVAC system, domestic water heaters, elevators and food service equipment (except walk-in refrigeration and/or freezer equipment), on-site corrective work shall begin within six (6) hours of Contractor's receipt of warranty work, 365 days per year 24 hours per day.
- .3 For walk-in refrigeration and/or freezer equipment, on-site corrective work shall begin within four (4) hours of Contractor's receipt of warranty work, 365 days per year, 24 hours per day.

§ 3.5.8 For warranty work requiring immediate response as described in 3.5.7 above, the Contractor shall maintain or contract for an answering service available 365 days per year, 24 hours per day.

§ 3.5.9 Warranty work shall be completed within six (6) hours after the initiation of on-site corrective work unless additional time is reasonably required, and the Owner has agreed on the additional time frame deemed necessary by the Contractor.

§ 3.5.10 The Owner reserves the right to complete any warranty work that Contractor fails to complete in the specified time period. Owner will backcharge Contractor for the cost of such work, including Consultants' fees.

§ 3.6 Taxes

§ 3.6.1 The Owner is exempt from the Texas Sales Tax on any purchase of tangible personal property and utilities and will issue Certificates of Exemption from the Texas Sales Tax on materials furnished by Contractors on School Construction projects. The Contractor shall give a written statement to the Owner (with a copy to the Architect) as to the proration of costs of skilled crafts, labor and materials for the project prior to awarding of a Construction Contract. The Contractors shall obtain Certificates of Resale from their suppliers in order to avoid payment of the State Sales Tax on materials incorporated in School jobs. Failure of the Contractor to obtain Certificates of Resale from their suppliers shall make the Contractor responsible for absorbing the tax.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.1.1 The Owner will pay directly or to the governing authority directly from the Allowance, the cost of all permanent connection charges, including water and sewer tap charges and the provision and installation of the irrigation meter and the domestic water meter and vault. The Owner will pay directly to the governing authority the cost of all non-taxable entity fees, capacity charges, drainage impact fees and permanent utility account deposits.

§ 3.7.1.2 The Contractor shall pay directly all temporary utility connection charges, including utility district/company inspection, survey, and permit fees for both temporary and permanent connections.

§ 3.7.1.3 The Contractor shall include in the Base Proposal, the cost for providing all backflow preventers, fire sprinkler system backflow preventers, meters, vaults, valves, taps, and piping from taps for domestic water, irrigation, and fire sprinkler systems.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 It is neither the Contractor's responsibility nor the Owner's responsibility to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations. However, if the Contractor observes or should have observed, that portions of the Contract Documents are at variance therewith, the Contractor shall promptly notify the Architect and Owner in writing, and necessary changes shall be accomplished by appropriate modification.

(Paragraphs deleted)

§ 3.7.4 If the Contractor performs Work which he knew or should have known it to be contrary to laws, statutes, ordinances, building codes, and rules and regulations without such notice to the Architect and Owner, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.8 Allowances

§ 3.8.1 The General Contractor shall include in his proposal all allowances stated in the Specifications.

These stated allowances represent the cost estimate of the materials and equipment delivered and unloaded at the site. The Contractor's supervision, handling costs, estimating costs, miscellaneous fees, overhead, profit, clean-up, as-builts, warranty, and other expenses contemplated for the allowance material and equipment shall be included in allowances only where called for in the various sections of these specifications.

The Contractor shall purchase the allowance materials and equipment as directed by the Architect, upon approval by the Owner, on the basis of the lowest reasonable proposal of at least three (3) competitive proposals unless otherwise directed by Owner. If the actual cost of the materials and equipment delivered and unloaded at the site is more than all the allowance estimates, the Contract Sum will be adjusted by Change Order.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- .1 Allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, miscellaneous fees, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- .3 Whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner in sufficient time to avoid delay of the Work.

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§ 3.9 Superintendent

§ 3.9.1 The General Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work including punch list work. The Superintendents and Project Manager shall be satisfactory to the Owner and Architect and shall not be changed except with the consent of the Owner and Architect, unless the Superintendent leaves the employment of the Contractor. No increase in Contract Time or Contract Sum shall be allowed in the event the Owner or Architects objects to any nominated superintendent or project manager. The superintendent and project manager shall represent the Contractor, and communications given to the superintendent and/or project manager shall be as binding as if given to the Contractor.

(Paragraphs deleted)

§ 3.9.2 The Contractor shall furnish to the Owner and the Architect in writing the names and professional qualifications of the persons proposed by the Contractor as the project manager and superintendent with the submitted proposal. The Contractor shall not assign nor substitute any person as the project manager or superintendent to whom the Owner or the Architect has made reasonable objection. No increase in Contract Time or Contract Sum shall be allowed in the event the Owner or Architect objects to any nominated project manager and/or superintendent. The Contractor's submittal of the project manager and superintendent's professional qualifications with his proposal represent the Contractor's acknowledgement that the selection committee's evaluation of the Contractor's proposal includes said superintendent's qualifications and the understanding that said job superintendent will remain on site, full time, until the Architect and Owner have agreed that all punch list work has been completed. See also, Specification Section 01 35 23 – Special Owner Requirements, for additional job superintendent requirements. In addition, the Owner reserves the right to perform a criminal records history review of the proposed superintendent and other Contractor personnel prior to the Contract Award as may be deemed necessary.

§ 3.9.3 Contractor will be required to keep the job superintendents on each job-site during the course of the construction until completion of all punch list items. In the event the job superintendents is absent from any job site at any time during the project contract time or during punch list completion and an agreed upon substitute is not provided, the Owner may backcharge the Contractor \$250.00 per occurrence.

§ 3.9.4 The Contractor shall notify the Owner and Architect at the beginning of the work day if the superintendent is out sick. If the superintendent is to be out for any other reason, the Owner and Architect are to be notified at least 24 hours in advance. In both cases the Owner and Architect are to be informed of the name of the acting superintendent.

§ 3.10 Contractor's Construction Schedules

§ 3.10.1 The Contractor shall, within the time frame specified in Section 01 32 16, prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

§ 3.10.2 The Contractor shall prepare a submittal schedule, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Architect's approval. The Architect's approval shall not unreasonably be delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.10.4 The Contractor will provide a detailed critical path construction schedule including milestones for this project within the time frame specified in 01 32 16. This schedule shall be prepared using "Suretrak, Primavera, Microsoft Project" or other similar scheduling software. In addition, the Contractor shall submit to the Owner and Architect with each monthly Application for Payment a copy of the progress schedule showing all modifications required to have the schedule reflect appropriate revisions and shall take whatever action is necessary to assure that the project completion schedule is met. The Contractor is required to attend and to give a schedule update at each weekly construction administration meeting and shall provide a detailed 3 week work ahead schedule. The progress schedule will include

percentages of work completed to date along with percentages of work remaining to be completed. These percentages will be used in the verification of the Contractor's monthly Application for Payment. Pay Applications will not be processed by the Owner unless accompanied by an updated progress schedule. If the project is behind schedule, specific input will be required from the Contractor on how he intends to make up the time. If the project remains behind schedule for more than ten (10) working days, for any reason, the Owner, Architect, and Consultants and their associated personnel, shall be compensated by the Contractor, at their standard hourly billing rate, which will be provided as required, until such time as the Contractor can successfully demonstrate to all parties that the project is back on the agreed schedule. Contractor shall provide two (2) large format color prints one (1) for Owner and one (1) for jobsite of the construction schedule monthly with all items showing current status and original baseline schedule.

§ 3.11 Documents and Samples at the Site

The Contractor shall maintain at the site for the Owner one (1) copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one (1) copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and shall be delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. Their purpose is to demonstrate the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Architect Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents, and (4) coordinated said shop drawings, product data, samples and submittals with adjacent work and its related submittals to be compatible and not in conflict for installation.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued

authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof, except for any such errors or omissions which are within the Architect's statutory or contractual design responsibility.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such written notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

(Paragraphs deleted)

§ 3.12.11 If, in the opinion of the Architect, the Shop Drawings are incomplete, indicate an inadequate understanding of the work covered by the Shop Drawings, or indicate a lack of study and review by the Contractor prior to submittal to the Architect, the Shop Drawings will be returned, unchecked, to the Contractor for correction of any of the above deficiencies and subsequent resubmittal. Additional service charges may be charged to the Contractor by the Architect in this event.

§ 3.12.12 The Contractor shall submit drawings, data and samples to the Architect at least fifteen (15) Regular Work Days prior to the date the Contractor needs the reviewed submittals returned. The Architect and his consultants will be allowed fifteen (15) Regular Work Days for checking from date of submission of shop drawings that are acceptable and do not require re-submission in the opinion of the Architect. Where colors are to be selected by the Architect, submit all product color samples in adequate time to allow the Architect to prepare a complete selection schedule. In general, all submittals requiring color selection shall be submitted to the Architect within eight (8) weeks [four (4) weeks for a summer remodel] of the Contractor's receipt of Notice to Proceed on the Project.

§ 3.12.13 The Contractor shall submit the number of copies of product data and samples which the Contractor and his subcontractors need for their use PLUS two (2) additional sets for the Architect, two (2) additional set for the Owner; one (1) additional set for each of the Architect's consultants involved with the particular Section of Work; (1) additional set of all mechanical shop drawings for TAB and one (1) additional set to be added to each copy of the Owner's Operation and Maintenance manuals at substantial completion. If, in the opinion of the Architect, the Shop Drawings are incomplete; indicate an inadequate understanding of the work covered by the Shop Drawings; or indicate a lack of study and review by the Contractor prior to submittal to the Architect, the Shop Drawings will be returned, unchecked, to the Contractor for correction of these deficiencies and subsequent resubmittal. Additional service charges as outlined in Article 3.2.7 may be charged to the Contractor by the Architect in this event.

§ 3.12.13.1 Where shop drawings are involved, submit one (1) high quality reproducible transparency and one (1) opaque print of the shop drawing for the Architect plus one (1) additional opaque print for each of the Architect's consultants involved with the particular Section of Work and one (1) additional print for each copy of the Owner's Operation and Maintenance Manuals to be submitted at Substantial Completion. The reproducible transparency will be marked by the Architect and/or his consultants and returned to the contractor for his use, distribution, correction or resubmittal, as

required. After final review and correction of the submittal, the Contractor shall send one (1) corrected set to the Architect and one (1) to each of the Architect's consultants involved with the particular Section of Work. Contractor shall also retain one (1) set of all reviewed Mechanical submittals to be transmitted to the HVAC Test and Balance agency selected by Owner.

§ 3.12.14 The Contractor shall deliver in one (1) submittal, all material samples requiring a color selection by the Architect, within eight (8) weeks [four (4) weeks for summer remodel] of the Contractor's receipt of a Notice to Proceed on the Project. The Architect will return material color selections within six (6) weeks [three (3) weeks for summer remodel] of receipt of the color samples from the Contractor.

§ 3.12.15 The Contractor shall produce and submit for review, composite coordination drawings within four (4) weeks of the Contractor's receipt of a Notice to Proceed on the Project. The composite coordination drawings shall depict the coordination of all structural and architectural elements with HVAC piping, ductwork, mechanical equipment, electrical conduit, low voltage systems cabling, lighting, electrical switchgear and panels, security systems, domestic water piping, roof drains and storm sewer piping, sanitary sewer piping and fire sprinkler piping in a composite above ceiling plan and a composite mechanical and electrical equipment room floor plan. Plans shall be produced at a scale of one-quarter (1/4") per foot and shall include larger scale sections with vertical elevations of elements required to confirm coordination of all elements. A schedule value for the production of the composite coordination drawings shall be included in the Continuation Sheet of the Application and Certificate for Payment for each of the Divisions of trade. Refer to specification section 01 31 13 for detail coordination document requirements.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.13.1 Contractor shall ensure that the Work, at all times, is performed in a manner that affords Owner reasonable access, both vehicular and pedestrian, to the site of the work and all adjacent areas. The Work shall be performed in such a manner that public areas adjacent to the site of the Work shall be free from all debris, building material and equipment likely to cause hazardous conditions. Without limitation of any other provision of the Contract Documents, Contractor shall use its best efforts to minimize any interference with the occupancy or beneficial use of any area of the building adjacent to the site of the Work, or the building, in the event of partial occupancy.

§ 3.13.2 Without prior approval of the Owner, the Contractor shall not permit any workers to use any existing facilities at the Project site, including without limitation, lavatories, toilets, entrances, and parking areas, other than those designated by the Owner. The Contractor shall comply with all rules and regulations established by the Owner in connection with the use and occupancy of the Project site and the Building.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting and patching shall be restored to the condition existing prior to the cutting, fitting and patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall, on a daily basis, keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials from and about the Project. See specification section 01 71 50 for specific requirements of final cleaning.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and Owner shall be entitled to reimbursement from the Contractor.

(Paragraphs deleted)

§ 3.15.3 Prior to the Architect's inspection for Substantial Completion, the Contractor shall clean exterior and interior surfaces exposed to view; remove temporary labels, stains, and foreign substances; polish transparent and glossy surfaces; clean equipment and fixtures to a sanitary condition; clean roofs; clean site; sweep paved areas and rake clean other surfaces; remove trash and surplus materials from the site.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect a job site plan and access to the Work, in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Architect. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law and to the extent claims, damages, losses or expenses are not covered by Project Management Protective Liability insurance purchased by the Contractor in accordance with Section 11.3, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, Third Party consultants, utility service providers involved with the project, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

§ 3.19 Substitutions of Materials, Products, or Systems

§ 3.19.1 The materials, products, and the systems covered by these specifications have been selected as a standard because of quality, particular suitability, or record of satisfactory performance. It is not intended to preclude the use of equivalent or better materials, products, or systems provided that same meets the requirements of the particular project and is approved in an addendum as a substitution prior to the submission of proposals. If prior written approval has not been obtained, it will be assumed that the Proposal is based upon the materials, products, and systems described in the Proposal Documents and no substitutions will be permitted, except as provided hereinafter.

§ 3.19.2 If, prior to submitting his Proposal, a Proposer at any level determines that any of the materials, products, or systems specified will perform in a manner that will limit the Contractor's ability to satisfactorily perform the work or to honor the Warranty, the Proposer shall promptly notify the Architect in writing, providing substantiation for his position. Any necessary changes shall be set forth in an addendum.

§ 3.19.3 The Architect does not bind himself to consider a substitution during the proposal period unless written

request has been submitted to the Architect for approval at least ten (10) days prior to the date for receipt of Proposals. Each such request shall include a "side-by-side" comparison which may include but is not limited to the following; a complete description of the proposed substitute, the name of the material, project, or system for which it is proposed to be substituted, drawings, cuts, performance and test data and any other data or information necessary for a complete evaluation. Incomplete submittals will not be evaluated. If the Architect approves any proposed substitution, such approval will be set forth in an Addendum.

§ 3.19.4 If, after award of contract, the Contractor or one of his Subcontractors or Suppliers determine that any of the products or systems specified will perform in a manner that will limit the Contractor's ability to satisfactorily perform the work or to honor the Warranty, the Contractor shall promptly notify the Architect, in writing, providing detailed substantiation for his position. Any changes deemed necessary by the Owner and Architect, including substitution of materials and change in Contract Sum, either upward or downward, if any, shall be accomplished by appropriate modification.

§ 3.20 Record Drawings

§ 3.20.1 Within seven (7) days after substantial completion of the project, the Contractor shall submit two (2) sets of full-size photocopies of the Job Superintendent's field set of marked plans and specifications.

§ 3.20.2 The Contractor shall provide the Owner with Electronic Record Drawings on a thumb drive or solid-state media drive. Drawings shall mirror the construction document sheets with any additions and changes made during the course of the project. Drawings shall be in both AutoCAD version 18 or later, and PDF or Tiff Format. CAD files shall have all referenced drawings in the same directory or folder. The record drawings shall include electronically all changes made during construction, clouded and keyed to identify the instrument of the change, Change Proposal Request or Change Order. For underground utility piping, revised locations shall also be dimensioned from the column grid lines. The record drawings must be delivered to the Architect at least thirty (30) days prior to receipt of the Contractor's Final Application for Payment. The record drawings shall have a statement added to indicate the purpose of the drawings (i.e. "RECORD DRAWINGS") and shall delete the Architects and/or Engineers seal. See additional requirements in Form 'AO'.

§ 3.20.3 The Contractor is to provide the Owner with Record Specifications (one (1) PDF format on thumb drive or solid-state media drive) which denotes the manufacture of materials incorporated into the Project where more than one acceptable manufacturer is listed, and shall include all changes made during construction, clouded and keyed to identify the instrument of change. The record specifications shall have a statement added to indicate the purpose of the specifications (i.e. "RECORD SPECIFICATIONS"). See additional requirements in Form 'AO'.

§ 3.21 Antitrust Violations

§ 3.21.1 To permit the Owner to recover damages suffered; in antitrust violations, the Owner/Contractor Agreement shall include the following wording, "Contractor hereby assigns to Owner any and all claims for overcharges associated with this contract which are under the antitrust laws of the United States, 15 U.S.C.A., Sec. 1 et.seq. (1973)". The Contractor shall include this provision in his agreements with each subcontractor and supplier. Each subcontractor shall include such provisions in agreements with sub-subcontractors and suppliers

§ 3.22 Prevailing Wage Rates

§ 3.22.1 No employee used in this construction may be paid less than the minimum wage rate provided herein in Article 15.

§ 3.23 Construction Progress Photographs

§ 3.23.1 Contractor shall provide color construction progress photographs during the construction period on a monthly basis to the Architect and Owner. Photographs and digital files on thumb drive or solid-state media drive of photos shall be provided. Construction progress monthly photographs (24 minimum per month, showing all aspects of work accomplished during that month) shall be provided with each and every application for payment.

§ 3.23.2 For New Construction, Building Additions and Miscellaneous Renovations provide (Digital files on thumb drive or solid-state media drive):

Two (2) aerial photographs prior to construction

Two (2) aerial photographs after Final Completion, and

Two (2) aerial photographs of the District facility site each month that there is a change in appearance of the

building exterior and site, or as requested by the Owner.

ARTICLE 4 ADMINISTRATION OF THE CONTRACT

§ 4.1 Architect

§ 4.1.1 The Architect is the person lawfully licensed to practice architecture or an entity lawfully practicing architecture identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Architect" means the Architect or the Architect's authorized representative.

§ 4.1.2 Duties, responsibilities and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner, Contractor and Architect. Consent shall not be unreasonably withheld.

§ 4.1.3 If the employment of the Architect is terminated, the Owner shall employ a new Architect against whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the former Architect.

§ 4.1.4 Except as expressly provided herein, the Contractor shall not be relieved of Contractor's obligation to perform the Work in strict accordance with the Construction Documents and the Contract Documents by the duties, responsibilities, or activities of the Architect.

§ 4.2 Architect's Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative (1) during construction, (2) until final payment is due and (3) with the Owner's concurrence, from time to time during the one-year period for correction of Work described in Section 12.2. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents unless otherwise modified in writing in accordance with other provisions of the Contract.

§ 4.2.2 The Architect shall visit the site at least twice per week (or more per week when deemed necessary by the Owner's Superintendent or Designee or when necessary to protect Owner's interests) and at any other intervals appropriate to the stage of construction, to inspect the progress, quantity and quality of the Work completed, to reject any observed nonconforming Work, and to determine if the Work is being performed in a manner indicating that the Work, when completed, will be in accordance with the Construction Documents and the Contract Documents and on time. Furthermore, a minimum of two job site meetings per month from commencement of construction through Final Completion will be initiated by the Architect and attended by the Contractor. Attendees will include Owner, the Contractor's project manager and/or superintendent, Architect's project representative, and Architect. The Architect, Owner and their representatives shall at all times have access to the Work. Architect, or its structural consultant will provide on-site observation prior to and during all concrete pours that contribute to the structural integrity of the building, including all pours of concrete piers, footings, grade beams, floor slabs, and concrete superstructure components, if applicable. In addition, Architect or its structural consultant will provide on-site observation prior to covering up or closing up of portions of the construction, which if covered, would conceal problems with the structural integrity of the Project. Contractor shall not close or cover said Work until said observations have occurred. Contractor or Architect will advise Owner of the need for any third-party laboratory or testing services to assist the Architect and Owner. On the basis of the on-site observations by Architect, Architect shall keep Owner and Contractor informed of the progress and the quality of the Work, through Architect's field reports, and shall guard Owner against defects and deficiencies in the Work. Architect shall promptly notify Owner and Contractor, orally, regarding any defect or nonconforming Work, which shall be followed by notice in writing of defects or nonconforming Work noted and corrective action taken or recommended. The Architect, however, shall not have control over, or responsibility for the Contractor's construction means, methods, techniques, sequences, procedures, or safety programs, but this does not relieve Architect of Architect's responsibilities under this Agreement. Any services by Contractor made necessary by Contractor's construction defect or nonconforming Work, shall be performed at no additional cost to Owner.

§ 4.2.3 The Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and report to the Owner (1) known deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of and will not be responsible for acts or

omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work. The Architect shall endeavor to guard the Owner against defects and deficiencies in the Work.

§ 4.2.4 Communications Facilitating Contract Administration

Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require additional inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness as to cause no delay in the work or in the activities of the Owner, Contractor, or Subcontractor, while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders, Change Proposal Requests, and Construction Change Directives, and may authorize minor changes in the Work as provided in Section 7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; will receive and forward to the Owner for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor, and will issue a final Certificate for Payment upon compliance with the requirements of the Contract Documents.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If no agreement is made concerning the time within which interpretations required of the Architect shall be furnished in compliance with this Section 4.2, then delay shall not be recognized on account of failure by the Architect to furnish such interpretations until 15 days after written request is made for them.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Contractor shall not cover up any work without the Architect and Owner performing an observation of such work. The Contractor will be responsible for any and all associated costs to allow for observations of the work, uncovered, by the Architect and Owner if the Contractor covers work without either the consent of the Architect and Owner or without providing the Architect and Owner with reasonable opportunity to observe the work, whether or not such work is found to be acceptable by the Architect or Owner.

§ 4.3 Claims and Disputes

§ 4.3.1 Definition. A Claim is a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner, Architect and Contractor arising out of or relating to the Contract. Claims must be initiated by written notice. The responsibility to substantiate Claims shall rest with the party making the Claim.

§ 4.3.2 Time Limits on Claims. Claims by either party must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later. Claims must be initiated by written notice to the Architect and the other party.

§ 4.3.3 Continuing Contract Performance. Pending final resolution of a Claim unless as otherwise agreed in writing, the Contractor shall proceed diligently with performance of the Contract.

§ 4.3.4 Claims for Concealed or Unknown Conditions. If conditions are encountered at the site which are (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then notice by the observing party shall be given to the other party promptly before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall so notify the Owner and Contractor in writing, stating the reasons. Claims by either party in opposition to such determination must be made within twenty-one (21) days after the Architect has given notice of the decision. If the conditions encountered are materially different, the Contract Sum and Contract Time shall be equitably adjusted, but if the Owner and Contractor cannot agree on an adjustment in the Contract Sum or Contract Time, the adjustment shall be referred to the Architect for initial determination, subject to further proceedings pursuant to Section 4.4.

§ 4.3.5 Claims for Additional Cost. If the Contractor wishes to make Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.6.

§ 4.3.6 If the Contractor believes additional cost is involved for reasons including but not limited to (1) a written interpretation from the Architect, (2) an order by the Owner to stop the Work where the Contractor was not at fault, (3) a written order for a minor change in the Work issued by the Architect, (4) failure of payment by the Owner, (5) termination of the Contract by the Owner, (6) Owner's suspension or (7) other reasonable grounds, Claim shall be filed in accordance with this Section 4.3.

§ 4.3.7 Claims For Additional Time

§ 4.3.7.1 If the Contractor wishes to make Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay only one Claim is necessary.

§ 4.3.7.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction.

§ 4.3.8 Injury or Damage to Person or Property. If either party to the Contract suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 4.3.9 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 4.3.10 Claims for Consequential Damages. The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes without limitation:

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 4.3.10 shall be deemed to preclude an award of liquidated direct damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 4.4 Resolution of Claims and Disputes

§ 4.4.1 Decision of Architect. Claims, including those alleging an error or omission by the Architect, shall be referred initially to the Architect for recommendation. If the parties are unable to agree, an appeal may be submitted as stated in Section 4.4.1.1 below.

§ 4.4.1.1 Any claim, disputes or matters arising out of this contract between the Architect, Owner and Contractor or any combination of those parties shall be submitted to a court of appropriate jurisdiction.

§ 4.4.2 The Architect will review Claims and within ten (10) days of the receipt of the Claim take one or more of the following preliminary actions: within ten (10) days of receipt of claim: (1) request additional supporting data from the claimant, (2) submit a schedule to the parties indicating when the Architect expects to take action, (3) reject the Claim in whole or in part, stating the reasons for rejection, (4) recommend approval of the Claim by the other party, or (5) suggest a compromise.

§ 4.4.3 In evaluating Claims, the Architect may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Architect in rendering a decision. The Architect may request the Owner to authorize retention of such persons at the Owner's expense.

§ 4.4.4 If the Architect requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten (10) days after receipt of such request, and shall either provide a response on the requested supporting data, advise the Architect when the response or supporting data will be furnished or advise the Architect that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Architect will either reject or approve the Claim in whole or in part.

§ 4.4.5 The Architect will approve or reject Claims by written decision, which shall state the reasons therefore and which shall notify the parties of any change in the Contract Sum or Contract Time or both. The approval or rejection of a Claim by the Architect shall be final and binding on the parties but subject to mediation.

§ 4.4.6 Upon receipt of a Claim against the Contractor or at any time thereafter, the Architect or the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Architect or the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 4.4.7 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines prior to resolution of the Claim by the Architect, or by mediation.

§ 4.4.8 If a Claim has not been resolved after consideration of the foregoing and of further evidence presented by the parties or requested by the Architect, the Architect will notify the parties in writing that the Architect's decision will be made within seven (7) days.

Upon expiration of such time period, the Architect will render to the parties the Architect's written decision relative to the Claim, including any change in the Contract Sum or Contract Time or both. If there is a surety and there appears to be possibility of a Contractor's default, the Architect shall notify the surety and request the surety's assistance in resolving the Claim.

§ 4.5 Mediation

§ 4.5.1 Any Claim arising out of or related to the Contract, except Claims relating to aesthetic effect and except those waived as provided for in Sections 4.3.10, 9.10.4 and 9.10.5 shall, after initial decision by the Architect or 30 days after submission of the Claim to the Architect, be subject to mediation only upon the mutual consent of both parties. In the event that mutual consent is not achieved, the parties are free to pursue any claims, disputes or matters in any manner allowed by law.

§ 4.5.2 Mediation, unless the parties mutually agree otherwise, shall be in accordance with the Construction Industry Mediation Rules of the American Arbitration Association currently in effect. Request for mediation shall be filed in writing with the other party to the Contract and with the American Arbitration Association.

§ 4.5.3 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

(Paragraph deleted)

§ 5.2.1 As soon as practicable after award of the Contract, but not later than five (5) days prior to the submittal date for the Contractor's first Application for Payment, the Contractor shall furnish in writing to the Owner and the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. Where subcontractors have been listed in the Specifications or on the Contractor's Proposal Form, the proposed entities shall be those firms listed in the Specifications and on the Contractor's Proposal Form, unless an agreement has been reached with the Owner to accept a proposed substitute(s). The Architect will promptly reply to the Contractor in writing stating whether or not the Owner or the Architect, after due investigation, has reasonable objection to any such proposed person or entity. Failure of the Owner or Architect to reply promptly shall constitute notice of no objection. Failure of the Contractor to submit the subject names in a timely manner will delay processing of the Contractor's Application for Payment.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made a timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made an objection under provisions of Subparagraph 5.2.1.

§ 5.2.3 If the Contractor has acted promptly and responsibly in submitting names as required, and the Owner or Architect objects to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no objection. The Contract Sum shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work.

§ 5.2.4 Prior to any substitution of a subcontractor by the Contractor, the Contractor shall notify the Architect of his intent and reasons for such proposed substitutions. The Contractor shall not substitute a Subcontractor, person or entity previously selected if the Owner or Architect objects to such change.

(Paragraphs deleted)

§ 5.2.5 The Contractor shall submit the list of proposed Subcontractors on AIA Document G805 or the form provided in the Project Manual.

§ 5.2.6 The Contractor is required to visit the site and completely familiarize himself with the existing conditions prior to the proposal. Neither additional increase in the Contract Sum nor extension in Contract Time will be granted when existing or known conditions require a certain amount of work to comply with the intent of the Contract Documents.

§ 5.3 Subcontractual Relations

By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. The Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors. Each subcontractor shall provide proof of insurance to Contractor consistent with the Contractor's insurance to Owner and in an amount commensurate with the Work to be performed by the Subcontractor.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

(Paragraph deleted)

§ 5.5 Neither the Owner nor the Architect shall be obligated to pay or to ensure the payment of any monies to subcontractors due to any non-payment to the Contractor or non-payment of subcontractors by the Contractor.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Section 4.3.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing their construction schedules when directed to do so. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights that apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6 and Articles 10, 11 and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

§ 6.2.3 The Owner shall be reimbursed by the Contractor for costs incurred by the Owner which are payable to a separate contractor because of delays, improperly timed activities or defective construction of the Contractor. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of delays, improperly timed activities, damage to the Work or defective construction of a separate contractor.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Change Proposal Request, Construction Change Directive, order for a minor change in the

Work, or a Change Proposal Request issued by Architect or Contractor, signed by Owner, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 All Change Orders and Change Proposal Requests shall be based upon agreement among the Owner, Contractor and Architect; a Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Change Proposal Request Construction Change Directive or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

§ 7.2.2 The parties mutually may agree upon a Change Order that adjusts Contract Time and/or Contract Sum based on a change in the Scope of Work requested by the Owner or that results from unanticipated, extraordinary adverse weather conditions as described in Article 15 of these General Conditions. The parties further agree that Contractor shall proceed with the Work only as set forth in a Change Order upon Contractor's physical receipt of a Change Order duly executed by the Owner. Contractor shall be entitled to reimbursement of a previously agreed to cost for estimating services.

§ 7.2.3 If a change in the Work is to be ordered, a written request shall be issued by Owner to Contractor describing the change and requesting the submission of a Change Order Request. When time does not permit the processing of a Change Order in advance of commencing the change in the Work, upon receipt of a written authorization from Owner, Contractor shall proceed with a change in the Work pursuant to a Construction Change Directive and Contractor shall concurrently proceed with submission of a Change Order Request.

§ 7.2.4 Within thirty (30) days following receipt of a written request, Contractor shall submit a Change Order Request to Owner together with the revised or new documents which, if approved, will become part of the Contract Documents setting forth any requested adjustment in the Contract Sum or the Contract Time, and including an itemization of all costs of material and labor with extensions listing quantities and total costs, and a substantiation of any Claim for an extension of the Contract Time. Any Change Order for a change in the work must be signed by the Owner before the Owner is obligated for payment related to the Change Order. If Contractor is unable to submit the above information within the time limit, it shall notify Owner in writing, setting forth for Owner's approval a date by which Contractor will submit the information as well as a schedule for the performance of the Work for which a Change Order Request will be forthcoming. If within the 30 days the Construction Manager cannot ascertain the financial or time impact of a claim a letter alerting the Owner of a forthcoming claim will suffice. This must be sent during this 30-day window.

§ 7.2.5 If Owner accepts a Change Order Request submitted by Contractor, Contractor shall prepare a Change Order that is based upon such Change Order Request for execution by Contractor and Owner and to the extent that the Owner and Contractor agree, the Contract Sum and Contract Time shall be adjusted as provided in the Change Order upon execution of such Change Order.

§ 7.2.6 Nothing contained herein shall limit the right of Owner to order changes in Work by Change Orders that have not been signed by Contractor, and Contractor shall promptly perform all Work required under the Contract Documents or a Change Order despite its failure to execute the Change Order. However, the Owner shall issue and execute a Change Order authorizing payment for all undisputed amounts.

§ 7.2.7 No change in the Work shall be the basis of an addition to the Contract Sum or a change in the Contract Time unless and until such change has been authorized by a Change Order executed and issued by the Owner in accordance with the Contract Documents. Changes in the Work may be made without notice to Contractor's sureties and absence of such notice shall not relieve such sureties of any of their obligations to Owner.

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§ 7.2.8 Acceptance of a Change Order by the Contractor shall constitute full accord and satisfaction for any and all Claims, whether direct or indirect, including but not limited to, impact or delay damages, arising from the subject matter of the Change Order; or attorneys' fees and costs arising from a dispute with a Subcontractor over the Change Order.

§ 7.2.9 Methods used in determining adjustments to the Contract Sum shall be those listed in Section 7.3.3.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive and/or Change Proposal Request shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 The cost or credit to the Owner resulting from a change in the Work shall be determined in one or more ways listed below. The first method listed shall be used unless the Architect determines that the method is inappropriate, in which case another method shall be selected:

- .1 By mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation. Contractor shall provide on company letterhead backup documentation and submit proposal cost and/or by either using unit costs method with attached supporting data or by using labor, materials and equipment method with attached supporting data. One form shall be utilized by each trade involved in the change in the work with an overall summary form by the Contractor for the entire change. Where additional Work is involved, the lump sum shall represent the estimated cost of labor and materials; plus markups to cover miscellaneous fees and profit if not funded by an allowance:

To compensate the Contractor or Subcontractor actually performing a part of the Work for the combined cost of miscellaneous fees and profit, the performing party shall be entitled to a single markup not to exceed 15% of the estimated cost of that part of the Work.

To compensate the Contractor for the combined cost of miscellaneous fees and profit on work performed by Subcontractors, the Contractor shall be entitled to a single markup not to exceed 10% of the subcontract amount if not funded from an allowance. (Contractor shall not be allowed a markup for miscellaneous fees and profit if change is funded by an allowance.)

When a Sub-subcontractor performs the Work of a change, the 15% markup for combined miscellaneous fees and profit shall be used only by the Sub-subcontractor. The Subcontractor and Contractor would each be entitled to a single markup not to exceed 10% of the cost to them from the Subcontractor and sub-subcontractor respectively if not funded by an allowance. (Contractor shall not be allowed a markup for miscellaneous fees and profit if change is funded by an allowance.)

- .2 By unit prices stated in the Contract Documents or subsequently agreed upon; Additional markups for miscellaneous fees, and profit will not be allowed in Unit Price Work;
- .3 By cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Subsection 7.3.6.
- .5 In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials, and Subcontracts. Labor and materials shall be itemized in the manner prescribed above on company letterhead. Where major cost items are Subcontracts, they shall be itemized also. In no case will a change be approved without such itemization.
- .6 For changes in the work the Contractor, Owner and Architect agree to be bound by the below stated required time lines.

Upon issuance of a Change document, Contractors, Subcontractors and Sub-subcontractors shall provide the proposed pricing on company letterhead with the required supporting back up

documentation no later than fifteen (15) business days after receipt of the proposed change document. Architect and Owner shall review Contractor's pricing and within ten (10) business days accept pricing as submitted by the Contractor or reject the pricing and return to the Contractor with specific reasons for rejections. If pricing is rejected, Contractor shall review the specific rejections and modify pricing to address the specific rejection and resubmit to the Architect and Owner comments within two (2) business days after receipt of rejection comments. The Architect and Owner shall review the revised pricing and either accept the revised pricing, or if pricing is still in dispute, the Architect shall issue a Construction Change Directive.

§ 7.3.4

(Paragraphs deleted)

Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.5 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.6 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect or Owner shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for miscellaneous fees, overhead and profit except if funded by Allowance. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:

- .1 costs of labor, including social security, retirement and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;
- .2 costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
- .3 rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others, and;
- .4 additional costs of supervision and field office personnel directly attributable to the change.

§ 7.3.7 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for miscellaneous fees and profit shall be figured on the basis of net increase or decrease, if any, with respect to that change.

§ 7.3.8 Pending final determination of the total cost of a Construction Change Directive to the Owner, amounts not in dispute for such changes in the Work shall be included in Applications for Payment accompanied by an approved Change Order or Change Proposal Request indicating the parties' agreement with part or all of such costs. For any portion of such costs that remains in dispute, the Architect will make an interim determination for purposes of monthly certification for payment for those costs. The determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 4.

§ 7.3.9 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and shall be recorded by preparation and execution of an appropriate Change Order.

(Paragraph deleted)

§ 7.4 Minor Changes in the Work

§ 7.4.1 The Architect has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents with Owner's written approval. Such changes will be effected by written order and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly with Owner's written approval.

§ 7.5 Changes Funded by Allowances

§ 7.5.1 Allowance balances may be used to fund changes in the work. The Contractor will not be allowed a mark-up for overhead and profit when changes in the work are funded by one of the Allowances. Cost for changes funded by allowances shall be determined by methods described in Article 7.3.3. Miscellaneous fees and profit mark-up shall be allowed on work performed by Subcontractors, Sub-subcontractors and the Contractor's own forces, in accordance with Section 7.2 and 7.3.

§ 7.5.2 Changes funded by Allowances shall require back-up documentation per Section 7.3.3.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 Unless agreed otherwise, the date inserted on the Agreement form and the Date of Commencement constitute "0" (zero) of the stated Completion Time.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined. The term "regular working day" as used in the Contract Documents shall mean any day from Monday through Friday, exclusive of those holidays normally recognized in the construction industry and/or approved by District-approved calendar.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner, and approved by the Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance. Unless the date of commencement is established by the Contract Documents or a notice to proceed given by the Owner, the Contractor shall notify the Owner in writing not less than five (5) days or other agreed period before commencing the Work to permit the timely filing of mortgages, mechanic's liens and other security interests.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by fire, or other causes beyond the Contractor's control; or by delay authorized by the Owner pending mediation and arbitration; or by other causes that the Architect and Owner determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect and Owner may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 4.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

§ 8.3.4 Extensions of time granted for causes described herein will be granted on the basis of one Regular Working Day extension for each Regular Working Day lost (i.e. seven (7) Calendar Days extension will be granted after five (5) Regular Work Days are lost except as modified by the provisions contained herein related to Anticipated Weather days).

§ 8.3.5 Each Proposer shall include in his proposed construction schedule an allowance of regular work days per year as defined in 1.7.7.4, in which work is delayed for student testing or other unspecified campus events. In addition, each proposer shall include an allowance of Anticipated Weather Days in accordance with following:

Number of anticipated Weather Days (These are regular working days)

January	5	July	8
February	5	August	8
March	5	September	7
April	4	October	4
May	7	November	6
June	7	December	5

§ 8.3.6 Weather Days shall pertain to such items as rain, flooding, snow, unusually high winds, excessively wet grounds, or the like which prevent progress on major portions of the work on regular working days only. If such situations occur on more than the number of Anticipated Weather Days indicated above and if those additional days prevent the Contractor from performing critical portions of the scheduled work, extensions of time cause by inclement weather may be requested as enumerated hereinafter: if the inclement weather is rain related, the rain at the site must have been in excess of 0.5 inch in 24 hours.

§ 8.3.7 At the beginning of each month the Contractor shall submit a status report for the preceding month, showing 1) the scheduled number of Anticipated Weather Days for the particular month, 2) the actual Weather Days requested, and 3) the Net Weather Days (plus, minus, or no change). At times deemed appropriate by the Architect or when requested in writing by the Contractor, the Contract time will be adjusted by Change Order if the total of Net Weather Days is substantially greater than "0". Unused Anticipated Weather Days may be accumulated during the Contract Time and may be used to offset Actual Weather days in other months. If the Contractor fails to submit said monthly status report, it will be assumed that none of the Anticipated Weather Days were used for that month and that they shall accumulate for possible future offset against Net Weather Days; however, if at the end of the project all Anticipated Weather days have not been used, the contract completion time will not be reduced. An example of the monthly schedule to be submitted is as follows:

Month	Anticipated Weather Days (Regular)	Actual Weather Days (Regular) Requested	Net Weather Days (Regular)
January	5	11	6
February	5	0	-5
March	5	2	-3
April	4	2	-2
May	7	12	5
June	7	11	4
Totals	33	38	5

Using this example (and assuming that all requested days were approved) there were 5 Net Weather Days (regular) for the six (6) months of the project and the extension of Contract Time would be seven (7) Calendar Days).

§ 8.3.8 Extensions of the Contract Time will only be considered after the number of anticipated delay days has been expended through mutual agreement by the Owner, Architect and Contractor.

§ 8.3.9 The following is a requirement of the Contract and will be included in the Agreement Between Owner and Contractor under Time of Completion and the blank spaces will be completed indicating the completion date as stated on the Proposal Form.

§ 8.3.10 The Work to be performed under this Contract shall be commenced in accordance with Section 8.1.2 and the following Substantial Completion Date(s) must be achieved. Refer to the Project Manual for description of Phasing, if any.

1. Refer to Document A101-2017 Standard Form of Agreement Between Owner and Contractor as amended, Article 3.3 for required substantial completion date(s).

The parties hereto agree that time is of the essence of this Contract and that the pecuniary damages which would be suffered by the Owner, if the Contractor does not achieve the phased construction completion called for in the Contract Documents by the specified dates, are in their very nature difficult to ascertain. Refer to Section 8.4 for Liquidated Damages.

§ 8.4 Liquidated Damages

§ 8.4.1 The parties hereto agree that time is of the essence of this Contract and that the pecuniary damages which would be suffered by the Owner, if the Contractor does not achieve the phased construction completion called for in the Contract Documents by the specified dates, are in their very nature difficult of ascertainment. The sums per Calendar Day to be paid in consideration of all actual costs such as rental costs, additional supplies, labor, overtime, and especially disruption of the educational programs and lost administrative time, which cannot be readily determined are as follows:

Elementary Schools (New Construction and/or Renovations):	\$1,000.00/Calendar Day
Middle Schools (New Construction and/or Renovations):	\$2,000.00/Calendar Day
High Schools (New Construction and/or Renovations):	\$3,000.00/Calendar Day
Athletic Fields (New Construction and/or Renovations):	\$1,000.00/Calendar Day
Miscellaneous Facilities (New Construction and/or Renovations):	\$1,000.00/Calendar Day

§ 8.4.1.1 It is therefore expressly agreed as a part of the consideration inducing the Owner to execute this Contract that the Owner may deduct from the Final Payment made to the Contractor an equitable sum per Calendar Day for each and every Calendar Day beyond the specified date of Substantial Completion, which the Contractor shall require for Substantial Completion of the Work included in this Contract. It is expressly understood that said sum per day is agreed upon as a fair estimate of the pecuniary damages which will be sustained by the Owner in the event that the work is not completed within the agreed time, or within the legally extended time, if any, otherwise provided for herein. Said sum shall be considered as Liquidated Damages only and in no sense shall be considered a penalty, said damages being caused by additional compensation to personnel, for loss of interest on money, and other increased costs, all of which are by their nature difficult of exact ascertainment.

§ 8.4.1.2 If the Contractor fails to complete all requirements of Final Completion within ninety (90) days after the actual Substantial Completion date, Contractor shall be required to attend weekly meetings at the job site or Owner's office until such time as the close-out documents and all punch list items are completed and accepted by Owner. During this time the General Contractor will be charged for the Owner's, Architect's, and any consultant's time. Billable time will include without limitation travel time, meeting time, document preparation, document review, and re-inspection of on-site conditions. These weekly meetings shall include a minimum two (2) hour charge per participant. Costs will be deducted from Contractor's Final Payment. Hourly rates shall be as follows:

Consultants:

- Principal Architect/Engineer/Consultant: \$175.00
- Project Architect/Engineer/Consultant \$150.00
- Staff Architect/Engineer/Consultant \$120.00
- Field Representative/Architect/Engineer/Consultant \$100.00
- Secretarial \$ 50.00

Project Owner:

• Associate Superintendent	\$225.00
• Assistant Superintendent	\$200.00
• Director	\$175.00
• Senior Project Manager	\$165.00
• Project Manager	\$150.00
• Project Coordinator	\$120.00
• Secretarial	\$ 50.00
• Maintenance Technician	\$ 50.00
• Operations Personnel	\$ 33.00

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

(Paragraph deleted)

§ 9.2 Schedule of Values

§ 9.2.1 Before the first Application for Payment, the Contractor shall submit to the Architect a schedule of values allocated to various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as the Architect and Owner may require. This schedule, unless objected to by the Architect or Owner, shall be used as a basis for reviewing the Contractor’s Applications for Payment.

§ 9.2.2 In order to facilitate the review of Applications for Payment, the Schedule of Values shall be submitted on AIA Documents G702 and G703 or other similar forms approved by the Owner, and shall include the following:

- .1 General Contractor’s costs for Contractor’s fee, bonds and insurance, mobilization, project close-out etc., shall be listed as individual line items.
- .2 Contractor’s costs for various construction items shall be detailed. For example, concrete Work shall be subdivided into footings, grade beams, floor slabs, paving, etc. These subdivisions shall appear as individual line items.
- .3 On major subcontracts, such as mechanical, electrical, plumbing, and low voltage, the schedule shall indicate line items and amounts in detail (e.g. underground, major equipment, fixtures, installation of fixtures, start up, close-out, etc.)
- .4 Costs for subcontract Work shall be listed without any addition of General Contractor’s costs for miscellaneous fees, profit or supervision.
- .5 Where payment for stored materials may be requested prior to installation, material and labor shall be listed as separate line items. Stored materials will only be paid for the amount of actual invoices of same materials.
- .6 Sample pages from an approved schedule of values are included in Section 01 29 73 of the project specifications.
- .7 Where work occurs at more than one building, for the Owner’s accounting purposes and to facilitate the checking and verification of the Contractor’s Application for Payment, cost shall be scheduled separately for each building on the G703 Continuation Sheets. Building additions and renovations shall be listed separately.
- .8 All work outside the building envelope excluding overhangs and canopies shall be listed separately under Site work.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten (10) days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment for operations completed in accordance with the schedule of values.

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Prior to this submittal, the Contractor shall contact the Architect's Field Department and Owner for on-site review of the proposed application. On-site reviews shall include review of all lien releases and stored materials. See project manual for additional requirements. Upon approval by the Architect's Field Department and Owner, the Application for Payment shall be notarized and submitted to the Architect. Included shall be data required to support lien releases, Application for Payment Checklist (Section CA), invoices and/or receipts. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and reflecting retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.8, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Change Proposal Requests, but not yet included in Change Orders.

(Paragraph deleted)

§ 9.3.2 Payments will be made on account of materials or equipment 1) incorporated in the Work and 2) Suitably stored at the site or 3) suitably stored at some off-site location provided the following conditions are met for off-site storage:

- .1 The location must be agreed to, in writing, by the Owner and Surety.
- .2 The location must be a bonded warehouse.
- .3 Surety must agree, in writing, to each request for payment.
- .4 The Contractor must bear the cost of the Owner's and Architect's expenses related to visiting the off-site storage area.
- .5 All items shall be marked and clearly tagged as property of the Owner.

Payments for materials or equipment stored on or off the site shall be conditioned upon submission by the Contractor of bills of sale or such other procedures satisfactory to the Owner to establish the Owner's title to such materials or equipment or otherwise protect the Owner's interest, including applicable insurance (naming the Owner as insured) and transportation to the site for those materials and equipment. Under no circumstances will the Owner reimburse the Contractor for down payments, deposits, or other advance payments for materials or equipment. Contractor shall only be paid for the amount of the actual invoices submitted as backup for stored materials.

The Contractor acknowledges that the review of materials stored off site is an additional service of the Architect and shall be charged for that service. The cost for that service will be established by the Architect and is not subject to appeal.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

§ 9.3.4 Contractor's progress payment draws for fees and general conditions (including miscellaneous fees and profit) shall not exceed the percentage completion of the Work in place for the entire Project as indicated on the Application for Payment.

§ 9.3.4.1 By signing each Application for Payment, Contractor stipulates and certifies the following: that the information presented is true, accurate, and complete; that the Contractor has made the necessary detailed examinations, audits, and arithmetic verifications that the submitted Work has been completed to the extent represented in the Application for Payment, that the materials and supplies identified in the Application for Payment have been purchased, paid for, and received; that the subcontractors have been paid as identified in the Application for Payment or that the Contractor has been invoiced for same; that he has made the necessary on-site inspections to confirm the accuracy of the Application for Payment; that there are no known mechanics' or materialmen's liens outstanding at the date of this requisition; that all due and payable bills with respect to the Work have been paid to date or are included in the amount requested in the current application; that except for such bills not paid but so included, there is no known basis for the filing of any mechanics' or materialmen's liens on the Work; that the Payment Application includes only Work self-performed by Contractor of for which Contractor has been invoiced; and that releases from all subcontractors and materialmen have been obtained in such a form as to constitute an effective release of lien under the laws of the State of Texas covering all Work performed and for which payment has been made by the Owner to the Contractor.

§ 9.3.5 Contractors shall submit digitally one (1) application using AIA Document G702 and G703, Application and

Certificate for Payment, 1992 Edition. All blanks in the form must be completed and signatures of Contractor and Notary Public must be original on each form.

§ 9.3.6 Contractor shall submit Application to the Architect in sufficient time (no later than Thursday at noon) to ensure that the Architect submits Application to the Owner on the first Monday of the Month (or previous business day if Monday is a Holiday as defined in this Agreement), prior to 12:00 pm. Applications will not be accepted on any other day of the week.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven (7) days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data comprising the Application for Payment, that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated and that the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Architect. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment, or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.4.3 The Architect will affix his signature to the same form described in Paragraph 9.3.4 to signify his certification of payment provided the application is otherwise satisfactory.

§ 9.4.4 The issuance of a Certificate for Payment shall constitute a recommendation to the Owner regarding the amount to be paid, this recommendation is not binding on the Owner if the Owner knows of other reasons under the Contract Documents why payment should be withheld.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 persistent failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

(Paragraphs deleted)

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven (7) days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 Neither the Owner nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor except as may otherwise be required by law.

§ 9.6.5 Payments to material and equipment suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

(Paragraph deleted)

§ 9.6.8 Based upon Applications for Payment and supporting documents including monthly updates of record drawings submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided in the conditions of the Contract as follows:

95% of the proportion of the Contract Sum properly allocable to labor, materials and equipment incorporated in the Work and 95% of the portion of the Contract Sum properly allocable to materials and equipment suitably stored at the site or at some other location agreed upon in writing by the parties; less the aggregate of previous payments in each case; and upon Substantial Completion of the entire work, a sum sufficient to increase the total payments to 95% of the Contract Sum less such retainages as the Architect shall determine for all incomplete work and unsettled claims.

Owner reserves the right to require that conditional Lien Releases be submitted by the Contractor and all subcontractors, sub-subcontractors and major suppliers with each Application for Payment after the first Application for Payment for which payment was made by the Owner for the certified amount for all previous applications for payments. Owner may withhold payment on-line items for which a lien or claim (or similar notice of intent) has been filed, until satisfactory release has been received by Owner.

Contractor shall not withhold as retainage a greater percentage for the Subcontractors or materialmen than the percentage that Owner withheld as retainage from payments to the Contractor.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment or notify Contractor of rejection, through no fault of the Contractor, within seven (7) days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven (7) days after the date established in the Contract Documents the amount certified by the Architect, then the Contractor may, upon seven (7) additional days' written notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.7.1 If the Owner is entitled to reimbursement or payment from the Contractor under or pursuant to the Contract Documents, then such payment shall be made promptly upon demand by the Owner. Any payments that are past due more than thirty (30) days after the Owner's invoice date may result in owner's rejection of Application for Payment.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work is sufficiently complete for the Owner to occupy, operate, and maintain the Work. Owner and Architect shall make the final determination as to which provisions of the Contract Documents are necessary to meet this criteria, whether or not such requirements are specifically enumerated in this Section or in other portions of the Contract Documents as being specifically required for Substantial Completion.

§ 9.8.1.1 The following items are a partial list of requirements, as applicable to the Project, that must be completed prior to the established Substantial Completion. This is not intended to be an exhaustive list, but a guideline:

1. All fire alarm system components must be completed and demonstrated to the Owner.
2. All inspections by government authorities having jurisdiction over the project must have been finalized, any remedial work required by them must have been completed, and Certificates of Occupancy, local fire marshal and health department approval certificates and similar governmental approval forms must have been issued and copies delivered to the Owner and Architect.
3. All exterior clean-up and landscaping must be complete, including required stand of grass mowed, edged, weeded, and fertilized.
4. All interior shall have been completed and cleaned except minor items which, if complete after occupancy, will not, in the Owner's opinion, cause interference to the Owner's use of the building or any portion thereof. Contractor shall provide list of these specific items, which include punch list and completion items. A significantly large number of items to be completed or corrected will preclude the Architect from issuing a Certificate of Substantial Completion. The Owner and Architect shall be the sole judge of what constitutes a significantly large number of items.
5. All third-party HVAC air and water balancing must be complete.
6. All energy management systems must be complete, fully operational and demonstrated to the Owner, with graphics transferred to the main server.
7. All emergency/standby generator and low voltage lighting control systems must be complete, fully operational and demonstrated to the Owner.
8. All security systems must be complete, fully operational and demonstrated to the Owner, and must be monitorable from the District's central Police/Security Center.
9. All school communications equipment, telephone systems and P.A. systems must be complete and demonstrated to the Owner.
10. All final lockset cores must be installed and all final Owner directed keying completed.
11. All room plaques and exterior signage must be complete.
12. All Owner demonstrations must be completed including kitchen equipment, HVAC equipment, plumbing equipment, and electrical equipment and all life safety systems.
13. A final certificate of occupancy must be signed by the Contractor and delivered to the Owner.
14. All operation and maintenance manuals are delivered and approved by Architect and Owner ("D-slant" ring binders in duplicate).
15. Health Department Inspections and Municipal Utility District (MUD) and Drainage District and County approvals must be provided.
16. All other reports, testing results, certifications, studies, etc. required by Contract Documents.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of

items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy, operate, and maintain the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Article 11 and authorized by public authorities having jurisdiction over the Work. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, and the Owner agrees that all closeout requirements have been fulfilled, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor

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knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner.

§ 9.10.3 Prior to final payment, the Contractor shall submit in triplicate (one (1) original and two (2) copies) to the Architect the following completed forms:

1. Contractor's Affidavit of Payment of Debts and Claims, AIA Document G706.
2. Contractor's Affidavit of Release of Liens, AIA Document G706A
3. Consent of Surety to Final Payment, AIA Document G707.
4. General Contractor's Guarantee - notarized
5. Subcontractor's Warrantees from each Subcontractor on Final Subcontractor List
6. All Subcontractors and suppliers and also any other parties that had submitted claims of non-payment shall submit Conditional Lien Releases – notarized. Executed document shall be dated within thirty (30) days of submission of final pay application.
7. Each Offeror (and Subcontractor and supplier submitting a proposal to an Offeror) shall submit a notarized affidavit stating that no asbestos, PCB or lead containing building materials were used on Owner's form.
8. Maintenance, inspection and warranty manuals. Two (2) sets of each bound in a 3-inch "D-slant" ring binder.
9. Record drawings. See Section 3.20.
10. Final Subcontractor List.
11. Refer to Specification Section 01 77 00, Guarantees, Certificates and Project Closeout for any additional information and requirements.
12. Executed TEA Project Compliance Certificate Form (Form 'AL').
13. Executed project Close-Out Form (Form 'AO'), and any additional provisions stated on Form 'AO' as being the responsibility of Contractor.

Documents identified as affidavit must be notarized. All documents requiring signatures must have original signatures (no stamps), and must indicate printed name of signer. All manuals will contain an index listing the information submitted. The index sections will be divided and identified by tabbing each section as listed in the index.

All Manufacturers' warranties must be on manufacturer's original form, indicating project name, and length of warranty.

The Owner may accept certain portions of the work as being complete prior to the acceptance of the entire project. If certain areas are accepted by the Owner as being complete, and if the Contractor has completed all of the requirements for final payment of that portion of work, the Owner may release retainage for that area/portion of work. Amounts of retainage shall be agreed upon by both Owner and Contractor prior to final acceptance of these areas.

Refer to Project Manual for additional requirements.

§ 9.10.4

(Paragraphs deleted)

If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

§ 9.10.5 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

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- .1 liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents; or
- .3 terms of special warranties required by the Contract Documents.

§ 9.10.6 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.1.1 Contractor's employees, agents, and Subcontractors and Sub-subcontractors shall not perform any service under this Contract while under the influence of alcohol or any controlled substance. Contractor, its employees, agents, and Subcontractors shall not use, possess, distribute, or sell illicit or unprescribed controlled drugs or drug paraphernalia, or misuse legitimate prescription drugs while performing the Work. Contractor, its employees, agents, and Subcontractors shall not use, possess, distribute, or sell alcoholic beverages while performing the Work.

§ 10.1.2 Contractor has adopted or will adopt its own policy to assure a drug and alcohol-free workplace while performing the Work. Contractor will remove any of its employees from performing the Work any time there is suspicion of alcohol and/or drug use, possession, or impairment involving such employee, and at any time an incident occurs where drug or alcohol use could have been a contributing factor. Owner has the right to require Contractor to remove employees from performing the Work any time cause exists to suspect alcohol or drug use. In such cases, Contractor's employees may only be considered for return to work after the Contractor certifies as a result of a for-cause test, conducted immediately following removal that said employee was in compliance with this Contract. Contractor will not use an employee to perform the Work who either refuses to take, or tests positive in any alcohol or drug test.

§ 10.1.3 Contractor will comply with all applicable federal, state, and local drug and alcohol related laws and regulations (e.g., Department of Transportation regulations, Department of Defense Drug-free Work-free Workforce Policy, Drug-Free Workplace Act of 1988). Owner has also banned the presence of all weapons on the Project Site, whether or not the owner thereof has a permit for a concealed weapon.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel. When use or storage of explosives or other Hazardous Substances (as hereinafter defined) or equipment or unusual construction methods are necessary, the Contractor shall give the Owner reasonable advance notice of the presence or use of such materials, equipment, or methods. Contractor shall be

responsible for any Hazardous Substances Contractor or Contractor's employees, contractors, consultants, subcontractors, sub-subcontractors, materialmen, and suppliers use, store, or otherwise introduce to the Premises.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

(Paragraphs deleted)

§ 10.2.8 The Contractor shall be responsible for taking all precautions necessary to protect the work in place from any weather conditions including without limitations to flooding, freezing, high winds, tropical storms, hurricanes, etc. which could cause any potential damage to portions or all work in place. The Contractor shall be responsible for performing all repairs and/or replacement of any work that results from such weather conditions.

§ 10.3 Hazardous Materials

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing.

§ 10.3.2 If requested in writing by the Contractor, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to verify that it has been rendered harmless. If requested in writing by the Contractor or Architect, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection.

(Paragraphs deleted)

§ 10.4 The Owner shall not be responsible under this Section 10.3 for materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents.

§ 10.5 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Section 4.3.7.

§ 10.6 Asbestos, Lead or PCBs Containing Materials

§ 10.6.1 The contractor and each subcontractor, **sub-subcontractor and suppliers** prior to final payment, shall submit an original notarized statement on their letterhead certifying "to the best of their information, knowledge, and belief asbestos-, lead-, and PCB-containing materials, and have not been used or incorporated into the Work and lead or lead-bearing materials have not been incorporated into potable water systems." For the purpose of definition as used in

this statement, the term "potable water systems" includes, but is not limited to, those water systems for drinking fountains, all sinks, showers, bath tubs, residential and commercial kitchen equipment, ice machines, and hose bibs, as applicable to the project.

§ 10.6.2 To the best knowledge of the Owner, the Architect and his consultants, no products or materials containing asbestos or polychlorinated biphenyl (PCB) or other toxic substances have been specified for this project. No products or materials containing asbestos or PCB are to be incorporated in this project. In the event the Contractor or his Sub-contractors become aware that any products or materials specified, ordered, scheduled for or already incorporated in the work on this project, contain asbestos, or PCB, the situation shall be reported immediately to the Owner and Architect in writing. An acceptable, equal substitute for the product or material in question shall be proposed by the Contractor and the product or material in question, if already onsite or incorporated in the work, shall be removed from the site immediately and returned to the supplier or manufacturer.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Liability Insurance

(Paragraph deleted)

§ 11.1.1 Refer to Section BD - Insurance and Bonds Requirements for Contractors and Facility Renters Cypress-Fairbanks Independent School District Insurance Management. The Contractor and Contractor's Subcontractors shall purchase and maintain, in a company or companies licensed and admitted by the Texas Department of Insurance to engage in the business of furnishing insurance in the State of Texas, the types and amounts of insurance as set forth in Section BD of the Agreement to protect it and the Owner from claims that may arise out of, or result from, the Contractor's operations under the Contract, whether such operations be by itself, or by any Subcontractor, or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable. All insurance companies shall have an "A-VIII" in Best's Rating Guide and shall be satisfactory to the Owner. No Work will be commenced until all requirements of this Article have been approved by the Owner in writing.

§ 11.1.2 The insurance required by Section BD - Insurance and Bonds Requirements for Contractors and Facility Renters Cypress-Fairbanks Independent School District Insurance Management shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from date of commencement of the Work until dates specified in Section BD.

§ 11.1.3 Original Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work. These certificates and the insurance policies required by this Section BD – Insurance and Bonds Requirements for Contractors and Facility Renters Cypress-Fairbanks Independent School District Insurance Management shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least thirty (30) days prior written notice has been given to the Owner. If any of the foregoing insurance coverages are required to remain in force after final payment and are reasonably available, an additional certificate evidencing continuation of such coverage shall be submitted with the Final Application for Payment as required by Section 9.10.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness in accordance with the Contractor's information and belief.

(Paragraphs deleted)

§ 11.2 Owner's Liability Insurance

§ 11.2.1 The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

(Paragraphs deleted)

§ 11.3 Project Management Protective Liability Insurance

§ 11.3.1 Optionally, the Owner may require the Contractor to purchase and maintain Project Management Protective Liability insurance from the Contractor's usual sources as primary coverage for the Owner's, Contractor's and Architect's vicarious liability for construction operations under the Contract. Unless otherwise required by the Contract Documents, the Owner shall reimburse the Contractor by increasing the Contract Sum to pay the cost of purchasing and maintaining such optional insurance coverage, and the Contractor shall not be responsible for purchasing any other liability insurance on behalf of the Owner. The minimum limits of liability purchased with such coverage shall be equal to the aggregate of the limits required for Contractor's Liability Insurance under Section 11.1.1.

(Paragraphs deleted)

§ 11.3.2 To the extent damages are covered by Project Management Protective Liability insurance, the Owner, Contractor and Architect waive all rights against each other for damages, except such rights as they may have to the proceeds of such insurance. The policy shall provide for such waivers of subrogation by endorsement or otherwise.

§ 11.4 Performance Bond and Payment Bond

§ 11.4.1 The Owner requires the Contractor to furnish payment and performance bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract in a total amount equal to 100% of the Contract Sum and in conformity with applicable law. All bonds shall be issued by a surety company licensed, listed, and authorized to issue bonds in the State of Texas by the Texas Department of Insurance. The surety company may be required by the Owner to have a rating of not less than "B" in the latest edition of Best's Insurance Reports, Property-Casualty. The surety company shall provide, if requested, information on bonding capacity, other projects under coverage and shall provide proof to establish adequate financial capacity for the Project. Should the bond amount be in excess of ten percent (10%) of the surety company's capital and surplus, the surety company issuing the bond shall certify that the surety company has acquired reinsurance, in a form and amount acceptable to the Owner, to reinsure the portion of the risk that exceeds ten percent (10%) of the surety company's capital and surplus with one or more reinsurers who are duly authorized and admitted to do business in Texas and that amount reinsured by a reinsurer does not exceed ten percent (10%) of the reinsurers capital and surplus.

§ 11.4.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall permit a copy to be made.

§ 11.4.3 The Contractor shall deliver the required Bonds to the Owner not later than the date of the preconstruction meeting if the Contract has been executed by Owner. All Bonds will be reviewed and approved by the Owner for compliance with the Contract Documents prior to the Contractor mobilizing onsite. Upon Owner approval, the Contractor will be allowed to mobilize onsite.

§ 11.4.4 All bonds shall be originals. The Contractor shall require the attorney in fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney. The name, address, and telephone number of a contact person for the Bonding Company shall be provided.

§ 11.4.5 Bonds shall guarantee the faithful performance of all the covenants, stipulations, and agreements of the Contract. Bonds shall be signed by an agent resident in the State of Texas and date of bond shall be the date of execution of the Contract. If at any time during the continuance of the Contract, the surety of the Contractor's bonds becomes insufficient, the Owner shall have the right to require additional and sufficient sureties which the Contractor shall furnish to the satisfaction of the Owner within ten (10) days after notice to do so. In default thereof, all payment or money due to the Contractor may be withheld until Contractor provides additional surety.

§ 11.4.6 It is distinctly understood that no mechanic, contractor, Contractor, materialman, vendor, artisan or laborer, skilled or unskilled, shall have, claim or acquire any lien upon the Project or any of the improvements in the Project, nor upon any of the land upon which the Project is located.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

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§ 12.2 Correction of Work

§ 12.2.1 Before or After Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one (1) year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

(Paragraph deleted)

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

§ 12.3.1 If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

§ 13.1.1 The Contract shall be governed by Texas law and mandatory and exclusive venue for any disputes shall be in Harris County, Texas.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to the other party hereto and to partners, successors, assigns and legal representatives of such other party in respect to covenants, agreements and obligations contained in the Contract Documents. Neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such

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an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

(Paragraph deleted)

§ 13.3 Written Notice

Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity, or to an officer of the corporation for which it was intended; or if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice.

(Paragraphs deleted)

§ 13.4 Rights and Remedies

§ 13.4.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

§ 13.4.2 No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach there under, except as may be specifically agreed in writing.

(Paragraphs deleted)

§ 13.5 Tests and Inspections

§ 13.5.1 Tests, inspections and approvals of portions of the Work required by the Contract Documents or by laws, ordinances, rules, regulations or orders of public authorities having jurisdiction shall be made at an appropriate time. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections or approvals which do not become requirements until after bids are received or negotiations concluded.

§ 13.5.2 If the Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Architect, their Consultants, or Owner's Third Party Consultant services, and expenses shall be at the Contractor's expense.

§ 13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.5.5 If the Architect is to observe tests, inspections or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.6 Commencement of Statutory Limitation Period

§ 13.6.1 As between the Owner and Contractor:

- .1 Before Substantial Completion. As to acts or failures to act occurring prior to the relevant date of Substantial Completion, any applicable statute of limitations shall commence to run and any alleged

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cause of action shall be deemed to have accrued in any and all events not later than such date of Substantial Completion;

- .2 Between Substantial Completion and Final Certificate for Payment. As to acts or failures to act occurring subsequent to the relevant date of Substantial Completion and prior to issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of issuance of the final Certificate for Payment; and
- .3 After Final Certificate for Payment. As to acts or failures to act occurring after the relevant date of issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of any act or failure to act by the Contractor pursuant to any Warranty provided under Section 3.5, the date of any correction of the Work or failure to correct the Work by the Contractor under Section 12.2, or the date of actual commission of any other act or failure to perform any duty or obligation by the Contractor or Owner, whichever occurs last.

§ 13.7 Refer to Specification Sections 01 35 23, 01 35 23.1 and 01 35 23.2 - Special Owner Requirements for additional requirements to be included as part of the Contract.

§ 13.8 The Owner shall have the right to examine, copy and/or audit the books and other records in possession of the Contractor relating to this Contract at any time deemed necessary by the Owner.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of sixty (60) consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, repeated suspensions, delays or interruptions of the entire Work by the Owner as described in Section 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven (7) days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work properly executed and for proven loss with respect to materials, equipment, tools, and construction equipment and machinery, including reasonable miscellaneous fees, profit, and damages.

§ 14.1.4 If the Work is stopped for a period of sixty (60) consecutive Calendar Days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven (7) additional days' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 TERMINATION BY THE OWNER FOR CAUSE

(Paragraphs deleted)

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§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
- .3 repeatedly disregards laws, ordinances, or rules and regulations, or orders of a public authority having jurisdiction; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.
- .5 fails to furnish the Owner, upon written request, with assurances satisfactory to the Owner, evidencing the Contractor's ability to complete the Work in compliance with all the requirements of the Contract Documents;
- .6 engages in serious or repeated worker misconduct in violation of Article 3.3.2;
- .7 engages in conduct that would constitute a violation of state or federal criminal law, including but not limited to, the laws prohibiting certain gifts to public servants, or engages in conduct that would constitute a violation of the Owner's ethics or conflict of interest policies; or
- .8 fails to proceed continuously and diligently with the construction and completion of the Work, except as permitted under the Contract Documents.

§ 14.2.2 When any of the above reasons exist, the Owner may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven (7) days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of the site and all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

(Paragraph deleted)

§ 14.2.3 The parties hereby agree that: 1) if an order for relief is entered on behalf of the Contractor, pursuant to Chapter 11 of the U.S. Bankruptcy Code; 2) if any other similar order is entered under any debtor relief laws; 3) if Contractor makes assignments for the benefit of one or more of its creditors; 4) if a receiver is appointed for the benefit of its creditors; or 5) if a receiver is appointed on account of its insolvency, any such event could impair or frustrate Contractor's performance of the Contract Documents. Accordingly, it is agreed that upon occurrence of any such event, Owner shall be entitled to request of Contractor or its successor in interest, adequate assurance of future performance in accordance with the terms and conditions of the Contract Documents. Failure to comply with such request within ten (10) days of delivery of the request shall entitle Owner to terminate the Contract and to the accompanying rights set forth in Subparagraphs 14.2.1 through 14.2.6. In all events, pending receipt of adequate assurance of performance and actual performance in accordance with the Contract Documents, Owner shall be entitled to proceed with the Work with Owner's own forces or with other Contractors on a time and material or other appropriate basis, the cost of which will be charged against the Contract Sum.

§ 14.2.4 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.5 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Architect, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.2.6 Contractor hereby assigns the Owner any and all claims for overcharges associated with this Contract which arise under the antitrust laws of the United States, 15 U.S.C.A. Section 1 ET.SEQ. (1973).

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

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§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment from the Owner on the same basis provided in Section 14.1.3.

(Paragraphs deleted)

ARTICLE 15 LABOR STANDARDS

(Paragraphs deleted)

§ 15.1 PREVAILING WAGE RATES

(Paragraphs deleted)

§ 15.1.1. Contractor, Contractor's Subcontractors and Sub-subcontractors shall pay all workers not less than the general prevailing rate of per diem wages for work of a similar character where the project is located as detailed in the "Minimum Wage Schedule" in section CB of the specifications, or as otherwise provided in the Contract Document. Wages listed are minimum rates only. However, no claims for additional compensation above the Contract Sum shall be considered by the Owner because of payments of wage rates in excess of the applicable rate provided herein. Texas Government Code § 2258.001 *et seq.*

(Paragraphs deleted)

§ 15.1.2 Contractor shall forfeit, as a penalty to the Owner, \$60 for each laborer, worker, or mechanic, employed for each calendar day or part of the day that the worker is paid less than the wage rates stipulated in the Contract Documents.

(Paragraphs deleted)

§ 15.1.3 Owner reserves the right to receive and review payroll records, payment records, and earning statements of employees of Contractor, and of Contractor's Subcontractors and Sub-subcontractors.

(Paragraphs deleted)

§ 15.1.4 If no prevailing wage rate schedule is made part of the Contract Documents, then the parties shall use the wage rate determined by the U.S. Department of Labor in accordance with the Davis-Bacon Act, 40 U.S.C. § 276a.

(Paragraphs deleted)

FORM BB

TEXAS STATUTORY PERFORMANCE BOND
(Penalty of this bond must be 100% of contract amount)

Bond No.: _____

KNOW ALL MEN BY THESE PRESENTS, that: _____
(hereinafter called the Principal), as Principal, and _____
a corporation organized and existing under the laws of the State of _____ authorized and
admitted to do business in the State of Texas and licensed by the State of Texas to execute bonds as Surety (hereinafter
called the Surety), as Surety, are held and firmly bound unto

(hereinafter called the Obligee) in the amount of _____

Dollars (\$ _____) for the payment whereof, the said Principal and Surety bind themselves, and
their heirs, administrators, executors, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated this _____ day
of _____.

**2024 CY RANCH HS RENOVATION
CYPRESS-FAIRBANKS INDEPENDENT SCHOOL DISTRICT
CYPRESS-FAIRBANKS I.S.D. PROPOSAL NUMBER: 24-02-5745R-RFP**

which contract is hereby referred to and made a part hereof as fully and the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall faithfully
perform the work in accordance with the plans, specifications and contract documents, then this obligation shall be
void; otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Chapter 22.53 of the Texas
Government Code and all liabilities on this bond shall be determined in accordance with the provisions of said Chapter
to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this Instrument this _____
day of _____.

Principal (Seal)

Surety Address By: _____
Signature and Printed Name

Surety Telephone Number _____
Surety (Seal)

By: _____
Attorney-in-Fact: Signature and Printed Name

FORM BC

TEXAS STATUTORY PAYMENT BOND **Bond No.:** _____
(Penalty of this bond must be 100% of contract amount)

KNOW ALL MEN BY THESE PRESENTS, that: _____
(hereinafter called the Principal), as Principal, _____
a corporation organized and existing under the laws of the State of _____ authorized and
admitted to do business in the State of Texas and licensed by the State of Texas to execute bonds as Surety (hereinafter
called the Surety), as Surety, are held and firmly bound unto

(hereinafter called the Obligee) in the amount of _____

Dollars (\$ _____) for the payment whereof, the said Principal and Surety bind themselves, and
their heirs, administrators, executors, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated this _____ day
of _____, _____.

**2024 CY RANCH HS RENOVATION
CYPRESS-FAIRBANKS INDEPENDENT SCHOOL DISTRICT
CYPRESS-FAIRBANKS I.S.D. PROPOSAL NUMBER: 24-02-5745R-RFP**

which contract is hereby referred to and made a part hereof as fully and the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall pay all
claimants supplying labor and material to him or a Subcontractor in the prosecution of the work provided for in said
contract, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Chapter 22.53 of the Texas
Government Code and all liabilities on this bond to all such claimants shall be determined in accordance with the
provisions of said Chapter to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this Instrument this _____
day of _____, _____.

Witness: _____ (Seal)
Principal

_____ By: _____
Signature and Printed Name

Witness: _____ (Seal)
Surety

_____ By: _____
Attorney-in-Fact: Signature and Printed Name

_____ Surety Address
_____ Surety Telephone Number

SECTION BD

INSURANCE AND BONDS REQUIREMENTS FOR CONTRACTORS AND FACILITY RENTERS

CYPRESS-FAIRBANKS INDEPENDENT SCHOOL DISTRICT INSURANCE MANAGEMENT

1.0 GENERAL

- A. The District shall require that the following insurance requirements be met on public works contracts:
1. No Work will be commenced until all requirements of this Section have been approved by the District in writing.
 2. The District shall be furnished a Declaration of Insurance evidencing all policies and endorsements required by this Section prior to proceeding with any work.
 3. The insurance shall contain a provision that at least thirty days prior written notice shall be given to the District in the event of cancellation, material change, or non-renewal.
 4. Insurance shall be underwritten by a company rated not less than B+ VII in Best's latest published guide.
 5. There shall be a hold harmless agreement in which the Contractor assumes liability on the contract and holds the School District harmless.
 6. The Contractor shall purchase and maintain in force the following kinds of insurance and bonds for operations under construction contracts and as specified in each section.
 7. No deletions/exclusions from standard coverage form are allowed without the written consent of Cypress-Fairbanks Independent School District.
 8. Furnish copies of subcontractors Certificates of Insurance to Owner.
 9. Furnish copies of Worker Compensation Documents to Owner.

2.0 CASUALTY INSURANCE

- A. Worker's Compensation Insurance Coverage

Definitions:

Certificate of coverage ("Certificate") - A copy of a certificate of insurance, a certificate of authority to self-insure issued by the commission, or a coverage agreement (TWCC-81, TWCC-82, TWCC-83, or TWCC-84), showing statutory workers' compensation insurance coverage for the person's or entity's employees providing services on a project, for the duration of the project.

Duration of the project - includes the time from the beginning of the work on the project until one (1) year after Substantial Completion of the project.

Persons providing services on the project ("subcontractor" in Texas Labor Code 406.096) - includes all persons or entities performing all or part of the services the contractor has undertaken to perform on the project, regardless of whether that person has employees. This includes, without limitation, independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity, or employees of any entity that furnishes persons to provide services on the project. "Services" shall include, without limitation, providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to a project. "Services" does not include activities unrelated to the project, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.

1. The contractor shall provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code 401.011 (44) for all employees of the contractor providing services on the project for the duration of the project.

2. The contractor must provide a certificate of coverage to the governmental entity prior to being awarded the contract. The certificate shall show Cypress-Fairbanks Independent School District as the certificate holder. The policy must be endorsed to provide a “waiver of subrogation in favor of Cypress-Fairbanks Independent School District.”
3. If the coverage period shown on the contractor’s current certificate of coverage ends during the duration of the project, the contractor must, prior to the end of the coverage period, file a new certificate of coverage with the governmental entity showing the coverage has been extended.
4. The contractor shall obtain from each person providing services on a project, and provide to the governmental entity:
 - a. a certificate of coverage, prior to that person beginning work on the project, so the governmental entity will have on file certificates of coverage showing coverage for all persons providing services on a project; and
 - b. no later than seven (7) days after receipt by the contractor, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project.
5. The contractor shall retain all required certificates of coverage for the duration of the project and two (2) years thereafter.
6. The contractor shall notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the contractor knows or should know, of any change that materially affects the provision of coverage of any person providing services on the project.
7. The contractor shall post on each project site a notice, in the text, form and manner prescribed by the Texas Workers’ Compensation Commission, informing all persons providing services on the project that they are required to be covered, and stating how a person may verify coverage and report lack of coverage.
8. The contractor shall contractually require each person with whom it contracts to provide services on a project, to:
 - a. provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011 (44) for all of its employees providing services on the project, for the duration of the project. The policy must be endorsed to provide a “waiver of subrogation” in favor of Cypress-Fairbanks Independent School District;
 - b. provide to the contractor, prior to that person beginning work on the project, a certificate of coverage showing that coverage is being provided for all employees of the person providing services on the project, for the duration of the project. The certificate shall show Cypress-Fairbanks Independent School District as the certificate holder;
 - c. provide the contractor, prior to the end of the coverage period, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project;
 - d. obtain from each other person with whom it contracts, and provide to the contractor:
 - 1) a certificate of coverage, prior to the other person beginning work on the project; and

- 2) a new certificate of coverage showing extension of coverage, prior to the end of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the project.
 - e. retain all required certificates of coverage on file for the duration of the project and for one year thereafter;
 - f. notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the person knew or should have known, of any change that materially affects the provisions of coverage of any person providing services on the project; and
 - g. contractually require each person with whom it contracts to perform as required by paragraphs a - g, with the certificates of coverage to be provided to the person for whom they are providing services.
9. By signing this contract or providing or causing to be provided a certificate of coverage, the contractor is representing to the governmental entity that all employees of the contractor who will provide services on the project will be covered by workers' compensation coverage for the duration of the project, that the coverage will be based on proper reporting of classification codes and payroll amounts, and that all coverage agreements will be filed with the appropriate insurance carrier or, in the case of self-insured, with the commission's Division of Self-Insurance Regulation. Providing false or misleading information may subject the contractor to administrative penalties, criminal penalties, civil penalties, or other civil actions.
10. The contractor's failure to comply with any of these provisions is a breach of contract by the contractor which entitles the governmental entity to declare the contract void if the contractor does not remedy the breach within ten days after receipt of notice of breach from the governmental entity.
11. The Contractor shall post the following language:

REQUIRED WORKERS' COMPENSATION COVERAGE

"The law requires that each person working on this site or providing services related to this construction project must be covered by workers' compensation insurance. This includes persons providing, hauling, or delivering equipment or materials, or providing labor or transportation or other service related to the project, regardless of the identity of their employer or status as an employee." Furnish copies of Workers' Compensation coverage for each person working on the project.

"Call the Texas Workers' Compensation Commission at (512) 440-3789 to receive information on the legal requirements for coverage, to verify whether your employer has provided the required coverage, or to report an employer's failure to provide coverage."

B. Commercial General Liability Insurance (Occurrence basis only).

Each Occurrence Limit		\$1,000,000 CSL
Products/Completed Operations	Aggregate	\$1,000,000
Personal and Advertising Injury	Occurrence	\$1,000,000
Fire Damage, Legal Liability	Any one fire	\$50,000
Medical Expenses	Any one person	\$5,000

- C. The Owner shall be named as an additional insured by endorsement on the Contractor's policy as to the subject job.

2.1 AUTOMOBILE LIABILITY INSURANCE

- A. Business (Commercial) Automobile Liability Insurance
 - 1. Coverage for all owned, non-owned and hired vehicles:

Bodily Injury/Property Damage	\$1,000,000 CSL
-------------------------------	-----------------

2.2 UMBRELLA LIABILITY INSURANCE (EXCESS) \$1,000,000

- A. The Owner shall be named as an additional insured on the Contractor's policy as to the subject job.
- B. This policy shall provide coverage over the Workmen's Compensation, Commercial General Liability and Business Automobile Liability policies.

2.3 PROPERTY INSURANCE (BUILDER'S RISK/INSTALLATION FLOATER)

- A. The policy shall be written in the name of the Owner, Contractor, and subcontractors as their interest may appear.
- B. The policy shall be written on an all risk basis for physical loss or damage and include theft, vandalism, malicious mischief.
- C. The amount of coverage shall be for the full insurable value of work.
- D. The deductible shall not be over \$1,000.00 without the approval of the Owner. (Deductible losses shall be paid by the Contractor.)
- E. The policy shall include an endorsement allowing Owner occupancy, and the insurance shall not be canceled or altered on account of partial occupancy prior to completion.
- F. A subrogation clause shall waive subrogation as to the Contractor, subcontractor, sub-subcontractors, the Owner and his employees and representatives.
- G. The original builders risk policy shall be furnished to the Owner prior to start of the job and maintained through Substantial Completion

3.0 BONDS

- A. Bonds are required for public works contracts under the following circumstances:
 - 1. Performance Bond and Labor and Material Payment Bond, each in a personal sum equal to 100% of contract sum if the formal contract is in excess of \$25,000.00.
 - 2. A Proposal Bond or Proposal Security in the amount of 10% of any proposal of \$25,000.00 or more must be submitted with formal proposals on public works contracts or as otherwise specified in each contract.
 - 3. Copies of the bonds shall be filed with the county clerk and the owner shall receive a file receipt.
 - 4. Performance and Payment Bonds shall remain in force for one (1) year after substantial completion.
 - 5. The Work will not be started until the bonds and issuing companies have been accepted in writing as satisfactory by the Owner.
 - 6. The original bonds will be delivered to the Owner with an attached authorized power of attorney.

END OF DOCUMENT

**SECTION CA
APPLICATION AND CERTIFICATION FOR PAYMENT
CHECK LIST AND TRANSMITTAL**

Date: _____ Application for Payment No.: _____
 Architect's _____
 Project: 2024 Cy Ranch HS Renovation Proposal Number: 1818-07-01
 Huckabee
 Owner: Cypress-Fairbanks Independent School District Architect: Architects
 Contractor: _____

Transmitted herewith is one (1) completed copy of the above referenced Application and Certificate for Payment. By initialing each item listed below, the undersigned certifies that he/she has personally checked and determined that each of the items is in compliance with the requirements of the Contract Documents.

Item	Description	CONTRACTOR Initial to Acknowledge Compliance	ARCHITECT Initial to Acknowledge Compliance	OWNER Initial to Acknowledge Compliance	Notes, Exceptions
A	One (1) complete copy of the above Referenced Application and Certificate for Payment, signed and Notarized, are enclosed.				
B	The grand totals of the Continuation Sheet match the amounts shown on the Application and Certificate for Payment.				
C	Percentage drawn for Supervision and General Conditions is less than or equal to the Continuation Sheet grand total percentage complete.				
D	Unconditional Release for each lien or claim that is applicable to period covered in Previously Approved Pay Application. Release must identify exact amount and period as stated in the Application for Payment.				
E	Conditional Release for each lien or claim that is applicable to period covered in Current Pay Application. Release must identify exact amount and period as stated in the Application for Payment.				
F	One (1) copy of Stored Materials Inventory List and Invoices enclosed for each line item of stored materials.				
G	One (1) Updated Construction Schedule enclosed.				
H	Recovery Plan from GC if project is behind schedule.				
I	Anticipated Weather Delay Log				
J	Construction Progress Photographs enclosed.				
K	Back charges are paid to date (e.g. Operations (Custodial)/Maintenance overtime, badges and retesting.)				

Submitted by (Signature): _____
 Name (Printed or Typed): _____
 Title: _____
 Date: _____

SECTION CB

**SUPPLEMENTARY CONDITIONS TO THE
GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION AS AMENDED**

Add the following Subparagraph:

1.1.11 DESCRIPTION OF PARTIES

The following definitions apply to parties named in the Contract Documents.

1. Owner: Cypress-Fairbanks Independent School
District Facilities & Construction Department
11430-B Perry Road
Houston, Texas 77064
Phone: (281) 897-4057
Representative: Jesse Clayburn, Asst. Superintendent of Facilities &
Construction
2. Architect: Huckabee, Inc.
1700 City Plaza Dr.
City Place 1, Suite 125
Spring, Texas 77389
Phone: (281) 520-4995
3. MEP Engineer: Salas O'Brien
738 Highway 6 South, Ste. 615
Houston, Texas 77079
Phone: (281) 945-8888
4. Structural: Dally & Associates, Inc
9800 Richmond Ave Suite 460
Houston, TX 77042
5. Civil Consulting: Dally & Associates, Inc
9800 Richmond Ave Suite 460
Houston, TX 77042
6. Acoustical / AV: BAI
4726 Rainbow Run
Sugarland, Texas 77479
7. Theatrical Lighting: Salas O'Brien
10930 W Sam Houston Pkwy N
Ste 900, Houston, TX 77064

2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

Add the following Subparagraph:

2.2.6 The Contractor will be furnished, free of charge, **one (1)** sets of drawings, specifications, and addenda, for pickup by the Contractor from the office of the Architect.

15.1 PREVAILING WAGE RATES

15.1.3 Prevailing Wage Rate Determination Information follows on the *next page*.

15.1 PREVAILING WAGE RATES

Prevailing Wage Rate Determination Information

The following information is from Chapter 2258 Texas Government Code:

Sec. 2258.021. Right to be Paid Prevailing Wage Rates.

- (a) A worker employed on a public work by or on behalf of the state or a political subdivision of the state shall be paid:
 - (1) not less than the general prevailing rate of per diem wages for work of a similar character in the locality in which the work is performed; and
 - (2) not less than the general prevailing rate of per diem wages for legal holiday and overtime work.
- (b) Subsection (a) does not apply to maintenance work.
- (c) A worker is employed on a public work for the purposes of this section if the worker is employed by a contractor or subcontractor in the execution of a contract for the public work with the state, a political subdivision of the state, or any officer or public body of the state or a political subdivision of the state.

Sec. 2258.023. Prevailing Wage Rates to be paid by Contractor and Subcontractor; Penalty.

- (a) The contractor who is awarded a contract by a public body or a subcontractor of the contractor shall pay not less than the rates determined under Section [2258.022](#) to a worker employed by it in the execution of the contract.
- (b) A contractor or subcontractor who violates this section shall pay to the state or a political subdivision of the state on whose behalf the contract is made, \$60 for each worker employed for each calendar day or part of the day that the worker is paid less than the wage rates stipulated in the contract. A public body awarding a contract shall specify this penalty in the contract.
- (c) A contractor or subcontractor does not violate this section if a public body awarding a contract does not determine the prevailing wage rates and specify the rates in the contract as provided by Section [2258.022](#).
- (d) The public body shall use any money collected under this section to offset the costs incurred in the administration of this chapter.
- (e) A municipality is entitled to collect a penalty under this section only if the municipality has a population of more than 10,000.

Sec. 2258.051. Duty of Public Body to Hear Complaints and Withhold Payment.

A public body awarding a contract, and an agent or officer of the public body, shall:

- (1) take cognizance of complaints of all violations of this chapter committed in the execution of the contract; and
- (2) withhold money forfeited or required to be withheld under this chapter from the payments to the contractor under the contract, except that the public body may not withhold money from other than the final payment without a determination by the public body that there is good cause to believe that the contractor has violated this chapter.

Prevailing Wage Rates – School Construction Trades

June 1, 2022

Texas Gulf Coast Area

CLASSIFICATION	2022 HOURLY RATE
ASBESTOS WORKER	\$21.13
BRICKLAYER; MASON	\$25.32
CARPENTER; CASEWORKER	\$23.38
CARPET LAYER; FLOOR INSTALLER	\$25.12
CONCRETE FINISHER	\$23.40
DATA COMM/TELE COMM	\$23.50
DRYWALL INSTALLER; CEILING INSTALLER	\$26.65
ELECTRICIAN	\$25.93
ELEVATOR MECHANIC	\$28.80
FIREPROOFING INSTALLER	\$22.25
GLAZIER	\$22.30
HEAVY EQUIPMENT OPERATOR	\$22.40
INSULATOR	\$20.50
IRONWORKER	\$25.50
LABORER, HELPER	\$16.71
LATHERER; PLASTERER	\$23.25
LIGHT EQUIPMENT OPERATOR	\$20.50
METAL BUILDING ASSEMBLER	\$21.10
MILLWRIGHT	\$33.63
PAINTER; WALL COVERING INSTALLER	\$19.60
PIPEFITTER	\$26.97
PLUMBER	\$26.71
ROOFER	\$20.50
SHEET METAL WORKER	\$19.90
SPRINKLER FITTER	\$26.13
STEEL ERECTOR	\$23.25
TERRAZZO WORKER	\$23.50
TILE SETTER	\$19.58
WATERPROOFER; CAULKER	\$19.88

Prevailing Wage Rates
Worker Classification Definition Sheet

CLASSIFICATION	DEFINITION
ASBESTOS WORKER	Worker who removes and disposes of asbestos materials.
BRICKLAYER; MASON	Craftsman who works with masonry products, stone, brick, block, or any material substituting those materials and accessories.
CARPENTER; CASEWORKER	Worker who builds wood structures or structures of any material which has replaces wood. Includes rough and finish carpentry, hardware, and trim.
CARPET LAYER; FLOOR INSTALLER	Worker who installs carpets and /or floor coverings, vinyl tile.
CONCRETE FINISHER	Worker who floats, trowels, and finishes concrete.
DATA COMM/TELE COMM	Worker who installs data/telephone and television cable and associate equipment and accessories.
DRYWALL; CEILING INSTALLER	Worker who installs metal framed walls and ceiling, drywall coverings, ceiling grids, and ceilings.
ELECTRICIAN	Skilled craftsman who installs or repairs electrical wiring and devices. Includes fire alarm systems and HVAC electrical controls.
ELEVATOR MECHANIC	Craftsman skilled in the installation and maintenance of elevators.
FIREPROOFING INSTALLER	Worker who sprays or applies fire proofing materials.
GLAZIER	Worker who installs glass, glazing, and glass framing.
HEAVY EQUIPMENT OPERATOR	Includes but not limited to all CAT tractors, all derrick-powered, all power operated cranes, back-hoes, back-fillers, power operated shovels, winch trucks, and all trenching machines.
INSULATOR	Worker who applies, sprays, or installs insulation.
IRONWORKER	Skilled craftsman who erects structural steel framing and installs structural concrete Rebar.
LABORER, HELPER	Worker qualified for only unskilled or semi-skilled work. Lifting, carrying materials or tools, hauling, digging, clean up.
LATHERER; PLASTERER	Worker who installs metal framing and lath. Worker who applies plaster to lathing and installs associated accessories.
LIGHT EQUIPMENT OPERATOR	Includes but not limited to, air compressors, truck crane drivers, flex planes, building elevators, form graders, concrete mixers less than 14cf), conveyers.
METAL BUILDING ASSEMBLER	Worker who assembles pre-made metal buildings.
MILLWRIGHT	Mechanic specializing in the installation of heavy machinery, conveyance, wrenches, dock levelers, hydraulic lifts, and align pumps.
PAINTER; WALL COVERING INSTALLER	Worker who prepares wall surfaces and applies paint and/or wall coverings, tape, and bedding.
PIPEFITTER	Trained worker who installs piping systems, chilled water piping and hot water (boiler) piping, pneumatic tubing controls, chillers, boilers, and associated mechanical equipment.
PLUMBER	Skilled craftsman who installs domestic hot and cold water piping, waste piping, storm system piping, water closets, sinks, urinals, and related work.
ROOFER	Worker who installs roofing materials, Bitumen (asphalt and coal tar) felts, flashings, all types of roofing membranes, and associated products.
SHEET METAL WORKER	Worker who installs sheet metal products, Roof metal, flashings and curbs, ductwork, mechanical equipment, and associated metals.
SPRINKLER FITTER	Worker who installs fire sprinklers systems and fire protectant equipment.
STEEL ERECTOR	Worker who erects and dismantles structural steel frames of buildings and other structures.
TERRAZZO WORKER	Craftsman who places and finishes Terrazzo
TILE SETTER	Worker who prepares wall and/or floor surfaces and applies ceramic tiles to these surfaces.
WATERPROOFER; CAULKER	Worker who applies water proofing material to buildings. Products include sealant, caulk, sheet membranes, and liquid membranes, sprayed, rolled, or brushed.

END OF DOCUMENT

Section CC

Right of Audit - Examination of Records

1. Records for all contracts, specifically including but not limited to lump sum contracts (i.e. fixed price or stipulated sum contracts), unit price, cost plus or time & material contracts with or without a guaranteed maximum (or not-to-exceed amounts) shall upon reasonable notice be open to inspection and subject to audit, scanning, and/or reproduction during normal business working hours. Such audits may be performed by any Owner's representative, or any outside representative engaged by Owner for the purpose of examining such records. The Owner or its designee may conduct such audits or inspections throughout the term of this contract and for a period of three years after final payment or longer if required by law. Owner's representatives may (without limitation) conduct verifications such as counting employees at the Construction Site, witnessing the distribution of payroll, verifying information and amounts through interviews and written confirmations with Contractor employees, field and agency labor, subcontractors, and vendors.
2. Contractor's "records" as referred to in this Exhibit shall include any and all information, materials and data of every kind and character, including without limitation, records, books, papers, documents, subscriptions, recordings, agreements, purchase orders, leases, contracts, commitments, arrangements, notes, daily diaries, superintendent reports, drawings, receipts, vouchers and memoranda, and any and all other agreements, sources of information and matters that may in Owner's judgment have any bearing on or pertain to any matters, rights, duties or obligations under or covered by any Contract Document. Such records shall include (hard copy, as well as computer readable data if it can be made available), written policies and procedures; time sheets; payroll registers; payroll records; cancelled payroll checks; subcontract files (including proposals of successful and unsuccessful bidders, bid recaps, negotiation notes, etc.); original bid estimates; estimating work sheets; correspondence; change order files (including documentation covering negotiated settlements); backcharge logs and supporting documentation; invoices and related payment documentation; general ledger, information detailing cash and trade discounts earned, insurance rebates and dividends; and any other contractor records which may have a bearing on matters of interest to the Owner in connection with the contractor's dealings with the Owner (all foregoing hereinafter referred to as "records") to the extent necessary to adequately permit evaluation and verification of any or all of the following:
 - a) Compliance with contract requirements for deliverables
 - b) Compliance with approved plans and specifications
 - c) Compliance with Owner's business ethics expectations
 - d) Compliance with contract provisions regarding the pricing of change orders
 - e) Accuracy of contractor representations regarding the pricing of invoices
 - f) Accuracy of contractor representations related to claims submitted by the contractor or any of his payees.
3. Contractor shall require all payees (examples of payees include subcontractors, material suppliers, insurance carriers, etc.) to comply with the provisions of this article by including the requirements hereof in a written contract agreement between Contractor and payee. Contractor will ensure that all payees (including those entering into lump sum contracts) have the same right to audit provisions contained in this contract.
4. Owner's authorized representative(s) shall have reasonable access to the Contractor's facilities, shall be allowed to interview all current or former employees to discuss matters pertinent to the performance of this contract and shall be provided adequate and appropriate workspace, in order to conduct audits in compliance with this article.
5. If an audit inspection or examination in accordance with this article, discloses overpricing or overcharges to the Owner (of any nature) by the Contractor and/or the Contractor's Subcontractors in excess of \$100,000 in addition to making adjustments for the overcharges, the reasonable actual cost of the Owner's audit shall be reimbursed to the Owner by the Contractor. Any adjustments and/or payments which must be made as a result of any such audit or inspection of the Contractor's invoices and/or records shall be made within a reasonable amount of time (not to exceed 90 days) from presentation of Owner's findings to Contractor.

Section CC

Right of Audit – Records to Be Provided to Owner’s Representatives Upon Request

In addition, to the normal paperwork documentation the Contractor typically furnishes to the Owner, in order to facilitate efficient use of Owner resources when reviewing and/or auditing the Contractor’s billings and related reimbursable cost records, the Contractor agrees to furnish (upon request) the following types of information in the specified computer (PC) readable file format(s):

Type of Record	PC Readable File Format
Monthly Job Cost Detail	.pdf and Excel
Detailed job Cost History To Date	.pdf and Excel
Monthly Labor Distribution detail (if not already separately detailed in the Job Cost Detail)	.pdf and Excel
Total Job to date Labor Distrubution detail (if not already included in the detailed Job Cost History to date)	.pdf and Excel
Employee Timesheets documenting time worked by all individuals who charge reimbursable time to the project	.pdf
Daily Foreman Reports listing names and hours and tasks of personnel who worked on the project	.pdf
Daily Superintendent Reports	.pdf
Detailed Subcontract Status Reports (showing original subcontract value, approved subcontract change orders, subcontractor invoices, payment to subcontractors, etc.	.pdf and Excel
Copies of Executed Subcontracts with all Subcontractors	.pdf
Copies of all executed change orders issued to Subcontractors	.pdf
Copies of all documentation supporting all reimbursable job costs (subcontractor payment applications, vendor invoices, internal cost charges, etc.)	.pdf

SECTION 01 10 00

SUMMARY OF WORK

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Project, **2024 Cy Ranch HS Renovation**, with campus locations at the following addresses:
- 10700 Fry Road, Cypress, Texas 77433
- for the Cypress-Fairbanks Independent School District.
- B. The Project(s) consists of but is not limited to:
Addition of Orchestra practice rooms, two art rooms, black box, stage storage at auditorium, replacement of auditorium A/V systems and controls and theatrical light fixtures, mechanical upgrades, and security enhancements.
- C. Project Schedule:
1. Substantial Completion date: July 26, 2026
 2. General phasing requirements refer to Part 3.1.B below.

1.2 CONTRACTS AND USE OF SITE

- A. Contractor Use of Premises:
1. Confine operations at site to areas permitted by law, permits, and Contract Documents, or as required to maintain campus operations (as approved by Owner).
 2. Do not unreasonably encumber site with materials or equipment. Refer to Contractor lay-down areas indicated on plans. If not indicated on plans provided, Contractor to submit for approval proposed Contractor designated areas, including but not limited to: lay-down, staging, parking, restroom, trailer, dumpster, field office, etc.
 3. Assume full responsibility for protection and safekeeping of products stored on premises.
 4. Obtain and pay for use of additional storage or work areas as needed for operations.
 5. Contractor shall establish secured staging area for work and coordinate and provide for safe passage and exit from existing building areas during construction, in compliance with all applicable codes and requirements of Owner.
 6. During phased construction, Contractor shall provide maps of building to Owner for each phase, showing construction area and impact to other areas of the building.
 7. Contractor shall coordinate all construction activities with school district officials.
 8. Owner reserves the right to perform construction operations with its own forces or to employ separate contractors on portions of the Project. General Contractor shall coordinate with Owner-performed work in terms of providing site access, workspace, and storage space, cooperation of work forces, scheduling, and technical requirements.
 9. Noise Control: Contractor shall coordinate equipment locations and timing of work activities so as to avoid conflict with the building occupants and/or avoid interference with facility meetings, events, or other activities.
 10. Utilities. The contractor is to coordinate all utilities permanent and temporary and make arrangements for installation for any service easements once the Owner provides information that a blanket or final easement exists.

11. Project Fencing:
 - a. Upon mobilization, the contractor shall build a wire mesh fence (or other type) as directed by Owner, at least six (6) feet high as shown on site plan and/or discussed during the pre-construction meeting.
 - b. Site fencing shall include emergency service and trucking gated in locations shown on the site plan and/or discussed during the pre-construction meeting.
 - c. Contractor shall properly maintain fencing and gates until Substantial Completion and only remove with concurrence from the Owner.

- B. Owner Occupancy:
 1. Refer to AIA Document A201™-2017, as amended.

- C. Owner-Furnished/Owner-Installed Items:
 1. The Owner reserves the right to place and install equipment in construction areas of the building prior to Substantial Completion, provided that such occupancy does not interfere with completion of the Work. Such placing of equipment shall not constitute acceptance of the total Work. Contractor shall protect Owner's property.

- D. Owner-Furnished/Contractor-Installed Items:
 1. The Owner may provide items to the Contractor for installation in accordance with manufacturer's recommendation and instructions.
 2. The Owner will arrange and pay for delivery of Owner-furnished items in accordance with the Contractor's Construction Schedule and will inspect deliveries for damage.
 3. If Owner-furnished items are damaged, defective or missing, through no fault of the Contractor, the Owner will arrange for replacement.
 4. The Contractor is responsible for designating the delivery dates of Owner-furnished items in the Contractor's Construction Schedule and for receiving, unloading and handling Owner-furnished items at the site. The Contractor is responsible for protecting Owner-furnished items from damage, including damage from exposure to elements, and to repair or replace items damaged as a result of his operations.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Refer to Specification Sections.

PART 3 - EXECUTION

3.1 CONSTRUCTION SCHEDULE

A. GENERAL DESCRIPTION OF WORK TO BE PERFORMED UNDER THIS CONTRACT

The Work to be performed under this contract shall commence on Notice to Proceed and shall be Substantially Complete as stipulated by AIA Document A101™-2017, as amended.

B. GENERAL CONSTRUCTION PHASING REFERENCING CFISD NEEDS BELOW, SHALL BE INCORPORATED INTO THE CONTRACT, INCLUDING BUT NOT LIMITED TO:

For the summer of 2025:

- Contractors may take over the building June 2, 2025.

- All athletic areas are to remain fully occupiable for the duration of the summer. Any work in the athletic areas will need to be coordinated with the campus. For gym work, only one gym can be under construction at any given time.
- All athletic, fine arts, dance, and cafeteria areas must be fully occupiable no later than July 15, 2025.
- The balance of the building shall be fully occupiable and turned back over to the district no later than July 27, 2025.
- Occupiable includes, but is not limited to, all life safety, MEP, architectural finishes in place, clean, and functioning as intended.
- Only work that can be removed and re-installed by these dates shall be performed during the summer.
- No partially complete work will be allowed after these dates unless approved in advance by the Owner.
- After these dates, all work shall be performed after hours, nights and weekends, while fully coordinating with the campus.

For the summer of 2026:

- Contractors may take over the building June 1, 2026.
- All athletic areas are to remain fully occupiable for the duration of the summer. Any work in the athletic areas will need to be coordinated with the campus. For gym work, only one gym can be under construction at any given time.
- All athletic, fine arts, dance, and cafeteria areas must be fully occupiable no later than July 15, 2026.
- The balance of the building shall be **SUBSTANTIALLY COMPLETE**, fully occupiable, and turned back over to the district no later than July 26, 2026.
- Occupiable includes, but is not limited to, all life safety, MEP, architectural finishes in place, clean, and functioning as intended.
- Only work that can be removed and re-installed by these dates shall be performed during the summer.
- No partially complete work will be allowed after these dates unless approved in advance by the Owner.
- After these dates, all work shall be performed after hours, nights and weekends, while fully coordinating with the campus.

Furniture Campus

This campus is receiving new student and administrative furniture via separate contract. However, General Contractor to comply with the following:

General Contractor to coordinate with CFISD and CFISD's vendor to provide interior and exterior clear unobstructed paths and access points for deliveries, product staging, product assembly, setup and disposal.

These areas must be available no later than July 15, 2025 and July 15, 2026 respectively.

- Delivery points will be accessible, clear and drivable by numerous eighteen wheeler trucks over a period of several weeks at middle and high schools.
- Staging/assembly areas include but are not limited to commons cafeteria, gyms, large group instruction, larger hallways (not impeding HCFMO fire egress), etcetera.
- Phased installation may include but not be limited to first setting up administration areas then academic classrooms, and finally ancillary support spaces last possibly spilling over from Summer into Thanksgiving week, Winter Break and Spring Break week if necessary
- As a guide, it is anticipated middle school furniture requires 2-3 weeks and high schools 3-4 weeks for phased installations.

END OF SECTION

SECTION 01 11 23

CODES, REGULATIONS AND STANDARDS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Quality Assurance
- B. References Standards
- C. Definitions
- D. Format and Specification Context Explanations
- E. Abbreviations
- F. Drawing Symbols
- G. General Requirements

1.2 QUALITY ASSURANCE

- A. General:
 - 1. For products or Workmanship specified by a standard of an association, trade, or Federal standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable code authorities having jurisdiction.
 - 2. The contractual relationship of the parties to the Contract should not be altered from the Contract Documents by mention or inference otherwise in any reference standard.
 - 3. Obtain copies of standards when required by Contract Documents.
 - 4. Maintain copy of standards at jobsite during submittals, planning, and progress of the specific Work for which the standards pertain, until the date of Substantial Completion.
 - 5. In the absence of specific instructions in the specifications, materials, products, equipment and their installation shall conform to the applicable codes, regulations and standards specified therein. When a conflict exists between the applicable code, regulation and standard and that specified, the more stringent code regulation or standard shall prevail, except as authorized by applicable authorities having jurisdiction.
- B. Industry Standards: Where compliance with two (2) or more industry standards or sets of requirements is specified and overlapping of those different standards or requirements establishes different or conflicting minimums or levels of quality, the most stringent requirement is intended and will be enforced, unless specifically detailed language written into the Contract Documents clearly indicates that a less stringent requirement is to be fulfilled. Refer questions to the Architect for a decision before proceeding.
- C. Contractor's Option: Except for overlapping or conflicting requirements, where more than one (1) set of requirements are specified for a particular unit of Work, the option shall be Contractor's regardless of whether or not it is specifically indicated as such.
- D. Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended to be the minimum for the Work to be performed or provided. Except as otherwise specifically indicated, the actual Work shall either comply exactly with the minimum (within specified tolerances). In complying with requirements, indicated numeric values are either minimums or

maximums as noted or as appropriate for context of requirements. Refer instances of uncertainty to Architect for decision before proceeding.

- E. Specialists; Assignments: In certain instances, specification text requires (or implies) that specific Work is to be assigned to specialists. Such Work shall be accomplished by the specified specialist. These requirements should not be interpreted so as to conflict with applicable regulations, union jurisdiction settlements and similar conventions. Such assignments are intended to establish which party or entity involved in a specific unit of Work is recognized as “expert” for the indicated construction processes or operations. Notwithstanding any such designation, the final responsibility for fulfillment of all Contract requirements remains with the Contractor.

1.3 REFERENCE STANDARDS

- A. Dates of codes, regulations and standards specified shall be the latest date of issue of that code, regulation or standard prior to the date of issue of this Project Manual or Document, except as modified or otherwise directed by the applicable codes and their supplements and amendments adopted by the code authorities having jurisdiction.
 - 1. Date of Issue - The “date of issue” as it appears in the statement above, means the date which appears on the cover of the Project Manual or Document corresponding to the date of issue of the Contract Documents.
 - 2. Code Authorities: The “code authorities” as it appears in the statement above, means the International Building Code (IBC) with City of Houston Amendments, Harris County Regulations, and those authorities responsible for code enforcement.

1.4 DEFINITIONS

- A. General Explanation: A substantial amount of specification language consists of definitions for terms found in other Contract Documents, including those in the AIA A201 General Conditions of the Contract for Construction as amended, Supplementary Conditions, the Drawings, and the Specifications. Drawings must be recognized as being diagrammatic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in the Contract Documents are defined in the General Conditions, Supplementary Conditions, and in this Section. Definitions and explanations contained in this Section are not necessarily either complete or exclusive but are general for this Work to the extent that they are not stated more explicitly in another element of the Contract Documents. In the event of a conflict in definitions or explanations within the Contract Documents or whenever there is need of clarification or interpretation of definitions within or between the Contract Documents, notify the Architect immediately and proceed as directed. Except in cases where definitions are determined by code authorities having jurisdiction, the Architect’s interpretation of all definitions will take precedence.
- B. General Requirements: The provisions or requirements of Division 1 - Sections apply to entire Work of Contract and, where indicated, to other elements which are included in the Project.
- C. Special Conditions: Wherever the term “Special Conditions”, appears in the Contract Documents, it refers collectively to all requirements of the Owner in addition to the sections in Division 1, General Requirements, and to Articles contained in the General Conditions and Supplementary Conditions.
- D. Architect: Wherever the term “Architect” appears in the Contract Documents, it means Huckabee Architects or their authorized representative(s).
- E. Bid, Competitive Sealed Proposal (CSP), Response, Offer, etc.: Wherever the term “Bid”, “Competitive Sealed Proposal (CSP)”, “Response”, “Offer”, “Proposal”, or any derivative thereof, or similar term appears in the Contract Documents, they mean one and the same, and shall mean Competitive Sealed Proposal, which by definition allows the Owner to accept the “best value” for the school district based on factors other than cost in selecting the Contractor.

- F. Contractor, General Contractor, etc.: Wherever the term “Contractor”, “General Contractor”, “Prime Contractor”, “Bidder”, “Bidder/Vendor”, “Vendor”, “Installer”, “Integrator”, “Subcontractor”, “Respondent”, “Offeror”, or any derivative thereof, or similar term appears in the Contract Documents, they mean one and the same, and shall refer to the entity (person or firm) licensed and meeting all applicable regulations of the State of Texas and Department of Labor to perform the Work, or their authorized representative(s).
1. Responsibilities: To avoid any misunderstanding or lack of interpretation, the responsibility for performing the Work is totally that of the entity defined above, and the resolutions proposed in his shop drawings and related documentation shall be demonstrated throughout the Work and specified warranty period.
 2. In the event of a controversy involving the Contract Documents or interpretation of Project requirements, the decision of the Architect will take precedence.
- G. Consultant: Wherever the term “Consultant”, or any derivative thereof appears in the Contract Documents, it means the following:
1. Owner's Consultants:
 - a. Third Party Plan Reviewer: Winning Way
 - b. Materials Testing: Ninyo and Moore
 - c. Roof Inspection: Terracon
 - d. Mechanical Testing and Balancing: Tab Tech
 - e. Commissioning: Terracon
 2. Architect's Consultants:
 - a. Civil Engineer: Dally & Associates
 - b. Structural Engineer: Dally & Associates
 - c. MEP Engineer: Salas O'Brien
 - d. Landscape Consultant: Dally & Associates
 - e. Roofing Consultant: Terracon
 - f. Asbestos Abatement Consultant: EFI Global, Inc.
 - g. Geotechnical Engineer: Raba Kistner, Inc
 - h. Traffic Engineer: N/A
 - i. Acoustical Engineer: BAi, LLC
- H. Indicated: Wherever the term “indicated”, or any derivative thereof appears in the Contract Documents, it means a cross-reference to graphic representations, notes, or schedules on Drawings, to other paragraphs or schedules in the Specifications, and to similar means of recording requirements in the Contract Documents. Where terms such as “shown”, “noted”, “scheduled”, and “specified” are used in lieu of “indicated”, it is for the purpose of helping reader locate cross-reference, and no limitation of location is intended except as specifically noted.
- I. Directed, Requested, Etc.: Where not otherwise explained, terms such as “directed”, “requested”, “authorized”, “selected”, “approved”, “required”, “accepted”, and “permitted” or any derivative thereof appears in the Contract Documents, it means as “directed by the Architect”, “requested by the Architect”, and similar phrases with actions taken by the Architect. However, no meaning or otherwise shall be interpreted to extend the Architect's responsibility into Contractor's area of construction supervision.
- J. Approve: Wherever the term “Approve”, or any derivative thereof appears in the Contract Documents, it means only the Architect, or an individual designated by him as his representative, can approve or disapprove contract actions. Even if the specifications indicate that an individual other than the Architect, such as the “Engineer” or “Consultant” will approve or disapprove an action, it is understood that only the Architect has this authority unless the individual is so designated by him in writing. Even when an individual is so designated, the Contractor may appeal the action to the Architect and the Architect's decision will be final. In no case will “approval” by the Architect

be interpreted as a release of the Contractor from responsibility to fulfill requirements of the Contract Documents.

- K. **Furnish:** Wherever the term “Furnish”, or any derivative thereof appears in the Contract Documents, it means supply or deliver to Project site, ready for unloading, unpacking, assembly, erection, placing, installing, anchoring, applying, curing, finishing, protecting, cleaning and similar operations, as applicable in each instance.
- L. **Install:** Wherever the term “Install”, or any derivative thereof appears in the Contract Documents, it means performing the operations at the Project site, of unloading, unpacking, assembly, erection, placing, installing, anchoring, applying, curing, finishing, protecting, cleaning and similar operations, as applicable in each instance.
- M. **Provide:** Wherever the term “Provide”, or any derivative thereof appears in the Contract Documents, it means furnish and install at the Project site, complete and ready for intended use, as applicable in each instance.
- N. **Project, Site:** Wherever the term “Project”, “Site”, or similar such term appears in the Contract Documents, it means the space available to the Contractor for performance of the Work, either exclusively or in conjunction with others performing Work as part of the Project. The extent of project or site is shown on the Drawings and may or may not be identical with description of land upon which Project is to be built.
- O. **District, School District, Owner, etc.:** Wherever the term “District”, “School District”, “Owner”, “Cy-Fair ISD”, “CFISD”, or similar such term appears in the Contract Documents, it means Cypress-Fairbanks Independent School District, 11430 Perry Road, Houston, Texas 77064, (281) 897-4057, or its authorized representative(s).
- P. **Installer:** Wherever the term “Installer”, or any derivative thereof appears in the Contract Documents, it means the entity (person or firm) engaged by the Contractor or its subcontractor or sub-subcontractor for performance of a particular unit of Work at the Project, including installation, erection, application and similar required operations. It is a general requirement that such entities (Installers) be expert in operations they are engaged to perform.
- Q. **Specialist:** Wherever the term “Specialist”, or any derivative thereof appears in the Contract Documents, it means an individual or firm of established reputation (or if newly organized, whose personnel have previously established a reputation in the same field), which is regularly engaged in, and which maintains a regular force of Workmen skilled in either (as applicable) manufacturing or fabricating items required by the Contract, installing items required by the Contract, or otherwise performing Work required by the Contract. Where the Contract Specification requires installation by a specialist, that term shall also be deemed to mean either the manufacturer of the item or firm who will perform the Work under the manufacturer’s direct supervision.
- R. **Testing Laboratory:** Wherever the term “Testing Laboratory”, or any derivative thereof appears in the Contract Documents, it means an independent entity engaged to perform specific inspections or tests of the Work, either at the Project site or elsewhere; and to report and (if required) interpret results of those inspections or tests.

1.5 FORMAT AND SPECIFICATION CONTEXT EXPLANATIONS

- A. **Underscoring:** Is used strictly to assist reader of specification text in scanning text for key words (for quick recall). No emphasis on or relative importance is intended where underscoring is used.
- B. **Capitalization:** Except for manufacturer, product, or trademark names, capitalization is used strictly to assist reader of specification text in scanning text for key words (for quick recall). No emphasis on or relative importance is intended where capitalization is used.

- C. Imperative language: Is used generally in specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities which must be fulfilled indirectly by the Contractor, or when so noted, by others.
- D. Section Numbering: Is used to facilitate cross-reference in Contract Documents. Sections are placed in Project Manual in numeric sequence; however, numbering sequence is not complete, and listing of sections at beginning of Project Manual must be consulted to determine numbers and names of specification sections in Contract Documents.
- E. Page Numbering: Pages are numbered independently for each section. The section number is shown preceded by the project number and followed by the page number at the bottom of each page, to facilitate the location of text. The project number is given to identify the project, for which specification was written, should the section become separated from the Project Manual.
- F. Specifying Methods: The techniques or methods of specifying to record requirements varies throughout text, and may include “prescriptive, “open-generic descriptive”, “compliance with standards”, “performance”, or a combination of these. The method used for specifying one unit of Work has no bearing on requirements for another unit of Work.

1.6 ABBREVIATIONS

- A. The language of Specifications and other Contract Documents is of the abbreviated type in certain instances and implies words and meanings which will be appropriately interpreted. Actual Work abbreviations of a self-explanatory nature have been included in texts. Specific abbreviations have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of specification requirements with notations on drawings and in schedules. These are frequently defined in section at first instance of use. Trade association names and titles of general standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of the Contract Documents so indicates. A list of typical abbreviations includes but is not limited to the following trade associations and organizations. Refer to Drawings and other Contract Documents for other abbreviations.

AA	Aluminum Association
AAMA	Architectural Aluminum Manufacturer's Assn.
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ACIL	American Council of Independent Laboratories
AGA	American Gas Association
AGC	Associated General Contractors of America
AHA	American Hardboard Association
AHGA	American Hotdip Galvanizers Association
AI	Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron & Steel Institute
AITC	American Institute of Timber Construction
ANSI	American National Standards Institute
APA	American Plywood Association
ARI	Air Conditioning & Refrigeration Institute
ASA	Acoustical Society of America
ASA	American Subcontractors Association
ASC	Adhesive & Sealant Council, Inc.
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASPE	American Society of Professional Engineers

ASAHC	American Society of Architectural Hardware Consultants
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
ASPI	American Wood Preserver's Institute
ASTM	ASTM International
AWI	Architectural WoodWork Institute
AWS	American Welding Society
BIA	Brick Institute of America
BRI	Building Research Institute
CRA	California Redwood Association
CLFMI	Chain Link Fence Manufacturers Institute
CRSI	Concrete Reinforcing Steel Institute
CSI	Construction Specifications Institute
DHI	Door and Hardware Institute
EPA	Environmental Protection Agency
FTI	Facing Tile Institute
FGMA	Flat Glass Marketing Association
GA	Gypsum Association
HPMA	Hardwood Plywood Manufacturers Association
IBC	International Building Code
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronic Engineers
JSMA	Joint Sealer Manufacturers Association
MFMA	Maple Flooring Manufacturers Association
ML/SFA	Metal Lath/Steel Framing Association
NAAMM	National Association of Architectural Metal Manufacturers
NAMM	National Association of Mirror Manufacturers
NBLP	National Bureau of Lathing & Plastering
NCPI	National Clay Pipe Institute
NCMA	National Concrete Masonry Association
NEMA	National Electrical Manufacturers Assn.
NESC	National Environmental Systems Contractors
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NHLA	National Hardwood Lumber Association
NOMMA	National Ornamental Metal Manufacturers Assn
NPVLA	National Paint, Varnish and Lacquer Assn.
NRMCA	National Ready Mixed Concrete Assn.
NRCA	National Roofing Contractors Association
NSPE	National Society of Professional Engineers
NWMA	National WoodWork Manufacturers Assn., Inc.
OSHA	Occupational Safety and Health Administration
PDCA	Painting and Decorating Contractors of America
PI	Perlite Institute, Inc.
PCA	Portland Cement Association
RFCI	Resilient Floor Covering Institute
RVFC	Rubber and Vinyl Floor Council
SBCCI	Southern Building Code Congress International, Inc.
SFPA	Southern Forest Products Association
SHLMA	Southern Hardwood Lumber Manufacturing Assn.
SDI	Steel Deck Institute
SDI	Steel Door Institute
SJI	Steel Joist Institute
SSPC	Steel Structures Painting Council
TCA	Tile Council of America, Inc.
UBC	Uniform Building Code

UL	Underwriter's Laboratories, Inc.
VBI	Venetian Blind Institute
VFI	Vinyl Fabrics Institute
WCLIB	West Coast Lumber Inspection Bureau
WRCLA	Western Red Cedar Lumber Association
WWPA	Western Wood Products Association

1.7 DRAWING SYMBOLS

- A. General: Except as otherwise indicated, graphic symbols used on drawings are those symbols recognized in the construction industry for purposes indicated. Where not otherwise noted, symbols defined by "Architectural Graphic Standards", published by the American Institute of Architects (AIA) and John Wiley & Sons, Inc., latest edition. Refer instances of uncertainty to Architect for clarification before proceeding.
- B. Mechanical/Electrical Drawings: Graphic symbols used in Mechanical/Electrical Drawings are generally aligned with symbols recommended by American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE). Where appropriate, those symbols are supplemented by more specific symbols as recommended by other recognized technical organizations, including, but not limited to American Society of Mechanical Engineers (ASME), American Society of Professional Engineers (ASPE), Institute of Electrical and Electronic Engineers (IEEE) and similar organizations. Refer instances of uncertainty to Architect for clarification before proceeding.

1.8 GENERAL REQUIREMENTS

- A. Color, Texture, or Pattern Requirements:
1. When color, texture, or pattern is specified, the item, product, or material shall be furnished in the specified color, texture, or pattern, as applicable.
 2. When more than one (1) approved manufacturer is named in the Specifications, Contractor may select any of the approved manufacturers and submit the full range of colors, textures, and patterns (standard and special) available of that manufacturer for the Architect's review and selection.
 3. When the term "match existing", or any derivative thereof appears in the Contract Documents, it means that the sample must match the Owner's existing Work in every respect as to color, texture, and pattern, as applicable.
 4. When the term "match Architect's approved sample", or any derivative thereof appears in the Contract Documents, it means that the Architect has selected a sample which must be matched in every respect as to color, texture, and pattern, as applicable.
 5. When an item or product is specified of a manufacturer for which only one (1) color, texture, or pattern is available, and a color, texture, or pattern other than that one is specified, Contractor shall bring it to the attention of the Architect for a decision prior to proceeding with the Work. Do not proceed with the Work until Architect has approved the color, texture, and pattern, as applicable.
 6. When an item or product is specified of a manufacturer for which no color, texture, or pattern is specified, and colors, textures, and patterns are available, Contractor shall bring it to the attention of the Architect and submit the full range of colors, textures, and patterns (standard and special) available of that manufacturer for the Architect's review and selection. Do not proceed with the Work until Architect has selected and approved the color, texture, and pattern, as applicable.
 7. When due to the nature of the item, product, or material, i.e., face brick, tile pavers, natural stone, etc, Contractor shall submit sample or samples which exhibits the full range of characteristics (colors, i.e. lights and darks, as well as textures, and patterns) for which the item, product, or material is available. The Architect will select the color, texture, and pattern, as applicable, from those available and request a sample panel exhibiting the approved characteristics. The approved color range, texture, and pattern, as applicable will then

- become the standard for which all Work on the project will be judged. Architect will be final judge as to having performed Work in conformance with approved characteristics.
8. Under no circumstances are colors, textures, patterns, or any other characteristics for which an item, product, or material are available to be selected by anyone other than the Architect or Owner.
 9. Non-conforming Work shall be removed from the site and replaced with new conforming Work at no additional expense to Owner.
- B. Continuity of Building Envelope, Full Height Partitions, and Fire Rated Construction:
1. Continuity of Building Envelope:
 - a. All materials such as exterior sheathing, membrane flashings, vapor barriers, insulations, dampproofing, waterproofing, roofing, flashings, etc. and all penetrations, holes, gaps, joints, and openings through such materials shall be sealed to ensure continuity of building envelope, whether indicated or not to eliminate moisture penetration.
 - b. Refer instances of uncertainty to Architect for clarification before proceeding with Work.
 2. Full Height Partitions:
 - a. All full height partitions shall be from floor to bottom of deck structure and shall be made to fit around steel joists, beams, etc., whether indicated or not.
 - b. Seal joints at top of partitions, in flutes of steel deck, and around structural elements with a compressible filler and/or sealant to accommodate movement due to expansion, contraction, and deflection, whether indicated or not. Treat seals in joints of fire rated partitions as specified below for fire rated construction, whether indicated or not.
 - c. Refer instances of uncertainty to Architect for clarification before proceeding with Work.
 3. Fire Rated Construction:
 - a. All seals in fire rated construction, whether at top, bottom, or penetrations through fire rated construction, shall be made with firestopping and firesafing materials to maintain fire rating integrity of construction and satisfy authorities having jurisdiction, whether indicated or not.
 - b. Refer instances of uncertainty to Architect for clarification before proceeding with Work.
- C. Plumbing Line Protection:
1. Placing or washing materials, including, but not limited to the following, down any plumbing line or fixture is strictly forbidden.
 - a. Concrete, cement, sludge, mortar, grout, plaster, or any other cementitious material
 - b. Paint, paint thinner, turpentine, kerosene, gasoline, oil, or any other petroleum or hazardous products.
 2. Cleaning painting equipment, including brushes in new or existing plumbing fixtures is strictly prohibited.
 3. Contractor shall certify that all affected plumbing lines and fixtures are clean, free flowing and running. Plumbing lines and fixtures damaged as a result of any of the above shall be repaired or replaced at no expense to Owner. Contractor shall bear responsibility and all costs of fines, penalties, and legal fees attributed to violations as levied by authorities having jurisdiction.
- D. Support from Structure: Ducts, pipes, conduits, equipment, and other items indicated to be supported from the structure shall be accomplished using approved hangwires, hangers, or devices of type, size and material recommended to suit the application and installed in accordance with recommendations of the hanger or device manufacturer, Architect and/or Structural Engineer, or code authorities having jurisdiction, whichever is the more stringent requirement. Nothing shall be hung from the structure unless directed to do so by the Architect and/or Structural Engineer.

- E. Ducts, Pipes, Conduits, and Wires: Shall be concealed in walls, chases, and enclosed areas out of view, unless specifically indicated as exposed or where exposure is required for proper function of item, such as air registers, air returns, louvers, grilles, vents, thermostats, electrical receptacles, telephone/data terminals and jacks, light switches, etc. Refer instances of uncertainty to Architect for clarification before proceeding.
- F. Fasteners:
1. Unless specifically indicated or directed otherwise, all fasteners in Work exposed to view, shall be concealed in the finished Work.
 2. No fasteners shall show through or telegraph through exposed face of finished Work and all finished surfaces shall be free of all evidence of the existence of fasteners.
 3. Fasteners shall be spaced to accurately and rigidly secure Work in place.
 4. If not shown or otherwise required or recommended by manufacturer, standard, or code authorities having jurisdiction, fastener spacing shall not exceed 12 inches on center.
 5. Non-conforming Work shall be removed from the site and replaced with new conforming Work at no additional expense to Owner.
- G. Exposed Metal Work:
1. Unless specifically indicated or directed otherwise, all exposed metal Work shall be flat with all surfaces free of distortions, oil canning, waves, dents, scratches, weld marks, and other surface defects detrimental to good appearance or function.
 2. All steel exposed to exterior shall be hot-dip galvanized, phosphate treated for paint retention and shop prime painted.
 3. Non-conforming Work shall be removed from the site and replaced with new conforming Work at no additional expense to Owner.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01 11 26

OWNER/ARCHITECT PROVIDED DOCUMENTS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 COPIES OF SUPPLEMENTARY CONTRACT DOCUMENTS

- A. The Owner and Architect have included the following Supplementary Contract Documents for the Offerors information. The Owner and Architect **do not** guarantee the accuracy, completeness, or suitability of this information, and the Offerors should verify the existing conditions prior to the Proposal date.
1. Topographic Survey:
 1. Entitled: Cypress Ranch High School out of the H.&T.C RP. Company Section 15 survey, Abstract no.433, W.c RP. company, Section 1 survey, Abstract no.914 and W.c Davis Section 2 Survey Abstract no. 1392
 2. Prepared for: Cypress Ranch High School (HS) Additions & Renovations
 3. Prepared by: West Belt
 4. Dated: June 24, 2024, Amended: July 22, 2024
 2. Geotechnical Investigation Report – Refer to Section 02 32 00
 1. Entitled: Project No. AHA24-031-00
 2. Prepared for: Cypress- Fairbanks Independent School District
 3. Prepared by: Raba Kistner, Inc
 4. Dated: July 28, 2024, Revised: September 27, 2024
- B. The boring log from the above-mentioned soils report is included in Section 02 32 00, Geotechnical Investigation.
- C. Any of the above documents bound in the drawing or specifications are included for reference purposes only.
- D. Neither Architect nor Owner guarantees their contents as to accuracy, completeness, or suitability.
- E. Copies may be examined at the Architect's office.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01 22 00

MEASUREMENT AND PAYMENT (UNIT PRICES)

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

Refer to Document AB for Substitutions of Materials and Equipment

1.1 SECTION INCLUDES

- A. Measurement and payment criteria applicable to portions of the Work performed under a unit price payment method.
- B. Defect assessment and non-payment for rejected work.

1.2 AUTHORITY

- A. Measurement methods delineated in the individual specification sections complement the criteria of this Section. In the event of conflict, the requirements of the individual specification section govern.
- B. Take all measurements and compute quantities. The Architect will verify measurements and quantities.

1.3 UNIT QUANTITIES SPECIFIED

- A. Quantities indicated in the Contract Documents are for bidding and contract purposes only. Quantities and measurements supplied or placed in the Work and verified by the Architect determine payment.
- B. If the actual Work requires more or fewer quantities than those quantities indicated, provide the required quantities at the unit sum/prices contracted.

1.4 MEASUREMENT OF QUANTITIES

- A. Measurement Devices:
 - 1. Weigh Scales: Inspected, tested, and certified by the applicable State Weights and Measures Department within the past year.
 - 2. Platform Scales: Of sufficient size and capacity to accommodate the conveying vehicle.
 - 3. Metering Devices: Inspected, tested, and certified by the applicable State department within the past year.
- B. Measurement by Weight: Concrete reinforcing steel, rolled or formed steel or other metal shapes will be measured by handbook weights. Welded assemblies will be measured by handbook or scale weight.
- C. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.
- D. Measurement by Area: Measured by square dimension using mean length and width or radius.
- E. Linear Measurement: Measured by linear dimension, at the item centerline or mean chord.
- F. Stipulated Sum/Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as a completed item or unit of the Work.

1.5 PAYMENT

- A. Payment Includes: Full compensation for all required labor, labor burden, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.
- B. Final payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities confirmed and accepted by the Architect multiplied by the unit/sum price for work which is incorporated in or made necessary by the Work.

1.6 DEFECT ASSESSMENT

- A. Replace the Work, or portions of the Work, not conforming to specified requirements.
- B. The individual specification sections may modify these options or may identify a specific formula or percentage sum/price reduction.
- C. The authority of the Architect to assess the defect and identify payment adjustment is final.

1.7 NON-PAYMENT FOR REJECTED PRODUCTS

- A. Payment will not be made for any:
 - 1. Products wasted or disposed of in a manner that is not acceptable.
 - 2. Products determined as unacceptable before or after placement.
 - 3. Products not completely unloaded from the transporting vehicle.
 - 4. Products placed beyond the lines and levels of the required work.
 - 5. Products remaining on hand after completion of the work.
 - 6. Loading, hauling and disposing of rejected Products.

PART 2 – DESCRIPTION OF UNIT PRICES

2.1 GENERAL

- A. For the work described unit pricing shall be used to determine the additional cost or credit to the contract amount or added to or deducted from the Owner’s contingency for changes in the scope of work made during the progress of the work as directed by Architect.
- B. The same price shall be used for adding or deducting from the scope of work. No exceptions.
- C. The following unit prices shall be included in the proposal form and shall be included in the Owner-Contractor agreement.

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

- A. Unit Prices shall be used, where applicable, to make adjustments to the cost of the work due to changes. All Unit Prices submitted shall be complete “turnkey” prices for fully functioning systems, and shall include all costs for overhead, profit, labor, labor burden, material, equipment, and any other incidentals related to the completion of the Work and shall remain firm for the duration of the contract. Unit prices listed are for additive and/or deductive work.

UNIT PRICE 1: ELECTRICAL DUPLEX RECEPTACLE

Provide unit price for a new 20A, 120V duplex electrical receptacle and cover plate, flush mounted in a CMU, metal stud, or demountable wall construction, circuited to an existing electrical panel within 150 feet of the

outlet using a branch circuit consisting of 2 #10 AWG and 1 #10 AWG ground in 3/4 inch EMT conduit. All conduits to be concealed in wall construction. Unit price shall include a 20 amp circuit breaker to be installed in existing panel space.

UNIT PRICE 2: DATA DROP

Provide unit price for a data drop, flush mounted in a CMU, metal stud or demountable wall construction., wired to an IDF/MDF Room. The data drop shall consist of a single gang wall box, cabling wiring device, cover plate, 3/4-inch conduit from outlet to above accessible ceiling, plenum-rated cabling routed above accessible ceiling to the nearest MDF or IDF location within 250 feet of the outlet. Termination and testing to be included in the unit price.

UNIT PRICE 3: VOICE DROP

Provide unit price for a voice drop, flush mounted in a CMU, metal stud or demountable wall construction., wired to the telecommunications/MDF room. The voice drop shall consist of a single gang wall box, voice jack, cover plate, 3/4-inch conduit from outlet to above accessible ceiling, plenum-rated voice cable routed above accessible ceiling to telecommunication head end equipment. Termination and testing to be included in the unit price.

UNIT PRICE 4: DATA CABLING TO TEACHER STATION

Provide one data drop, including data jack, faceplate, and CAT 6 cable home run to nearest IDF or MDF data rack. Assume length less than 300 FT. Include J-box and conduit from data outlet to ceiling cavity in this unit price.

UNIT PRICE 5: 4 1/2" THICK CONCRETE WALK PER SQUARE FOOT

This unit cost shall establish the amount to the contract price for the Contractor to add or deduct 4 1/2" thick concrete walk (minimum 100 SF) per Square Foot.

UNIT PRICE 6: 7" THICK CONCRETE DRIVE PER SQUARE FOOT

This unit cost shall establish the amount to the contract price for the Contractor to add or deduct 7" thick concrete drive (minimum 100 SF) per Square Foot.

UNIT PRICE 7: PAINTING

This unit cost shall establish the amount to be added or deducted to the contract price for the Contractor to paint 100 square feet of wall (minimum 400 square feet of wall).

UNIT PRICE 8: ORNAMENTAL FENCE

This unit cost shall establish the amount to be added or deducted from the contract price for the Contractor to add/deduct ornamental fence.

- | | | | |
|----|--------------------------------|------------|-------------|
| 1. | 6 foot high fence | \$ _____ / | linear foot |
| 2. | 6 foot high x 4 foot wide gate | \$ _____ / | per leaf |
| 3. | 6 foot high x 6 foot wide gate | \$ _____ / | per leaf |

UNIT PRICE 9: SECURITY FILM AND GLAZING

This unit cost shall establish the amount to be added to the contract price to provide and install security film on existing exterior glazing (minimum 200 square feet).

- 1. Armouredone 23 Mil Film \$ _____/ Square foot
- 2. Childgard 3/8” \$ _____/ Square foot
- 3. Childgard 9/16” \$ _____/ Square foot

END OF SECTION

SECTION 01 23 00

ALTERNATES

PART 1 - GENERAL

1.1 ALTERNATE PRICES

- A. Contractor shall state, in the spaces provided in the proposal form, Alternate Prices for the work described below. The responsibility of determining quantity of Alternates rests with the Contractor. Base Proposal and Alternates shall include cost of all supporting elements required, so that no matter what combination of Base Proposal and Alternates are accepted, that portion shall be a complete entity. Work for all Alternates shall be in strict accordance with the specification sections noted and applicable to the specific work.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 ALTERNATES

- A. **Alternate Number 1: Base Bid Adjustment**
This alternate shall establish the adjustments to the General Contractor's Base Proposal submitted at 2:00 pm, if necessary. This alternate shall be accepted whether it is an add or a deduct and will be used as part of the evaluation process to determine the best value for the District.

3.2 GENERAL NOTES

- A. Unless otherwise indicated, scope of work for each alternate shall include material and labor, general conditions and all other costs associated with completing the work described.
- B. Alternates are not listed in any order of priority.
- C. Acceptance of alternates shall be the sole discretion of the Owner.
- D. See Section AB for alternate pricing timelines.

END OF SECTION

SECTION 01 29 73

SCHEDULE OF VALUES

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Instructions to Proposers for substitutions.
- B. Provide a detailed breakdown of the agreed Contract Sum showing values allocated to each of the various parts of the work, as specified herein and in other provisions of the Contract Documents.

1.2 QUALITY ASSURANCE

- A. Use required means to assure arithmetical accuracy of the sums described. All calculations shall be to two (2) decimal places.
- B. When so required by the Owner, provide copies of the subcontracts or other data acceptable to the Owner, substantiating the sums described.

1.3 SUBMITTALS

- A. Prior to the first Application for Payment, submit a proposed Schedule of Values to the Owner and Architect as outlined below:
 - 1. Meet with the Owner and Architect and determine additional data, if any, required to be submitted.
 - 2. Secure the Owner's approval of the Schedule of Values prior to submitting first Application for Payment.

1.4 SCHEDULE OF VALUES

- A. The Schedule of Values shall be broken down into item costs for each specification section as a minimum with materials and labor separated. After review by the Owner and Architect, the Schedule of Values shall be broken down into further items as required. (See following list).
- B. Schedule of Values: Refer to the following sample.
- C. Indicate page subtotals on each page of Schedule of Values.
- D. Each page to be printed single-sided.
- E. Schedule of Values is to be submitted for approval per AIA Document A101, Article 3.3

PART 2 – PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 SCHEDULE OF VALUES

- A. Refer to sample attached herein.

**SECTION 01 29 73
 SCHEDULE OF VALUES - SAMPLE**

Item No.	Description of Work	Scheduled Value	Work Completed		Stored Matls	Total Completed	%
			Previous App.	This App.			
	<p><i>NOTE: IF PROJECT CONSISTS OF BOTH NEW ADDITION(S) AND REMODEL (S), EACH SHALL HAVE A SEPARATE SCHEDULE OF VALUES. Listing shall include but not be limited to:</i></p> <p>Div. 1 - General Conditions Sitework Supervision Mobilization Contractor's Fee General Conditions Temp. Facilities Project sign Coordination drawings Final Cleaning As-Builts/Close-out/O&M Manuals/Record Drawings Permits Bonds Insurance Contractor's written Punch List</p> <p>Div. 2 - Existing Conditions</p> <p>Div. 3 - Concrete Drilled Piers Matls Drilled Piers Labor Caps & Beams Matls Caps & Beams Labor Slab on Grade Matls Slab on Grade Labor Cooling Tower Basin Matls Cooling Tower Basin Labor Misc. Bldg Concrete Matls Misc. Bldg Concrete Labor Rebar Matls Rebar Labor Lt. Wt. Insul Fill - Matls Lt. Wt. Insul Fill - Labor Close-out Documents Punch List</p>						

Div. 4 - Masonry

Brickwork - Matls
Brickwork - Labor
Concrete Masonry - Matls
Concrete Masonry - Labor
Str. Glazed Tile - Labor
Str. Glazed Tile - Matls
Masonry clean up/acid wash
Close-out Documents
Punch List

Div. 5- Metals

Structural Steel - Matls
Structural Steel - Labor
Misc. Steel - Matls

Steel Joists - Matls

Lt. Gauge Steel Framing - Matls
Lt. Gauge Steel Framing - Labor
Metal Decking - Matls
Metal Decking - Labor
Expansion Covers - Matls
Expansion Covers - Labor
Alternating Stairs Matls
Alternating Stairs Labor
Close-out Documents
Punch List

Div. 6 - Wood & Plastics

Rough Carpentry - Matls
Rough Carpentry - Labor
Millwork - Matls
Millwork - Labor

Div. 7 - Thermal & Moisture Protection

Waterproofing & Dampproofing Matls
Waterproofing & Dampproofing Labor
Building Insulation - Matls
Building Insulation - Labor
Fireproofing - Matls
Fireproofing - Labor
Metal Roof - Matls
Metal Roof - Labor
Metal Roof Guarantee
Modified Bitumen Roofing Base Sheet- Matls
Modified Bitumen Roofing Base Sheet - Labor
Modified Bitumen Roofing Cap Sheet - Matls

Modified Bitumen Roofing Cap Sheet - Labor
Modified Bitumen Roofing - Guarantee
Building Sheet Metal - Matls
Building Sheet Metal - Labor
Bldg. Sheet Metal Guarantee
Roof Curbs Matls
Roof Curbs Labor
Roof Hatches Matls
Roof Hatches Labor
Sealants Matls
Sealants Labor
Roof Accessories Matls
Roof Accessories Labor
Close-out Documents
Punch List

Div. 8 - Doors & Windows

Finish Carpentry/Door - Matls
Finish Carpentry/Door - Labor
Finish Hardware - Matls
Finish Hardware - Labor
Thresholds & Seals Matls
Thresholds & Seals Labor
Hollow Metal Doors & Frames - Matls
Hollow Metal Doors & Frames - Labor
Plastic Faced Doors - Matls
Plastic Faced Doors - Labor
Overhead Doors & Grilles - Matls
Overhead Doors & Grilles - Labor
Alum. Entrances & Storefronts - Matls
Alum. Entrances & Storefronts - Labor
Alum. Windows - Matls
Alum. Windows - Labor
Glass & Glazing - Matls
Glass & Glazing - Labor
Glass & Glazing - water test
Close-out Documents
Punch List

Div. 9 - Finishes

Lath & Plaster - Matls
Lath & Plaster - Labor
Gypsum Wallboard Systems - Matls
Gypsum Wallboard Systems - Labor
Ceramic Tile - Matls
Ceramic Tile - Labor
Quarry Tile - Matls
Quarry Tile - Labor
Terrazzo - Matls

Terrazzo - Labor
Acoustic Clg. - Matls
Acoustic Clg. - Labor
Acoustic Wall Panels - Matls
Acoustic Wall Panels - Labor
Resilient Flooring - Matls
Resilient Flooring - Labor
Carpet - Matls
Carpet - Labor
Athletic Flooring - Matls
Athletic Flooring Labor
Floor Sealer - Matls
Floor Sealer - Labor
Painting - Matls
Paint - Labor
Close-out Documents
Punch List

Div. 10 - Specialties

Tackboards - Matls
Tackboards - Labor
Toilet Partitions - Matls
Toilet Partitions - Labor
Louvers - Matls
Louvers - Labor
Aluminum Flag Pole - Matls
Aluminum Flag Pole - Labor
Graphics -Matls
Graphics -Labor
Lockers Matls
Lockers Labor
Locker combinations in Excel format
Demountable Partitions - Matls
Demountable Partitions - Labor
Metal Shelving Matls
Metal Shelving Labor
Scoreboards - Matls.
Scoreboards - Labor
Toilet Room Accessories - Matls
Toilet Room Accessories - Labor
Visual Display Boards - Matls
Visual Display Boards - Labor
Cubicle Curtains & Track - Matls
Cubicle Curtains & Track - Labor
Fire Extinguisher Cabinets Matls
Fire Extinguisher Cabinets Labor
Close-out Documents
Punch List

Div. 11 - Equipment

Stage Curtains Matls
Stage Curtains Labor
Stage rigging Matls
Stage rigging Labor
Stage lighting Matls
Stage lighting Labor
Misc. Appliances Matls
Misc. Appliances Labor
Food Service - Submittals/coordination drawings
Food Service - Walk-ins Matls
Food Service - Walk-ins Labor
Food Service - Flatwork - Matls
Food Service - Flatwork - Labor
Food Service Eqpt - Labor
Food Service Eqpt - Matls
Food Service - Close-out Documents
Food Service - Training
Food Service - Kitchen Hoods - Matls
Food Service - Kitchen Hoods - Labor
Food Service - Ansul Syst. - Matls
Food Service - Ansul Syst. - Labor
Close-out Documents
Punch List

Div. 12 - Furnishings

Casework - Matls
Casework - Labor
Science Casework - Matls
Science Casework - Labor
Horizontal Blinds - Matls
Horizontal Blinds - Labor
Projection Screen - Matls
Projection Screen - Labor
Close-out Documents
Punch List

Div. 13 - Special Construction

Div. 14 - Conveying Systems

Elevator - Matls
Elevator - Labor
Elevator - Maintenance Agreement

Div. 21 - Fire Suppression

Fire Sprinkler Syst. - Eng/Submittals
Fire Sprinkler Syst. - Underground piping/Vault -
Matls

Fire Sprinkler Syst. - Underground piping/Vault - Labor
Fire Sprinkler Syst. - Above slab piping - Matls
Fire Sprinkler Syst. - Above slab piping - Labor
Fire Sprinkler Syst. - Trim-out - Matls
Fire Sprinkler Syst. - Trim-out - Labor
Fire Sprinkler Syst. - Start-up/Testing
Fire Sprinkler Syst. - Close-out Documents
Close-out Documents
Punch List

Div. 22 - Plumbing

Shop Drawings
Coordination Drawings
As-Builts/Close-out O&M Manuals
Sanitary Underground - Matls
Sanitary Underground - Labor
Storm Underground - Matls
Storm Underground - Labor
Domestic Water - Matls
Domestic Water - Labor
Plumbing Dissolution Matls
Plumbing Dissolution Labor
Gas Piping - Matls
Gas Piping - Labor
Grease Trap - Matls
Grease Trap - Labor
Fixtures - Matls
Fixtures - Labor
Rodding/Camera lines

Div. 23 - Heating Ventilating and Air Conditioning

Shop Drawings
As-Builts/Close-out O&M Manuals
Coordination drawings
Chillers - Matls
Chillers - Labor
Cooling Towers - Matls
Cooling Towers - Labor
Boilers - Matls
Boilers - Labor
AHU's - Matls
AHU's - Labor
Fans - Matls
Fans - Labor
Grilles -Matls
Grilles - Labor
Ductwork - Matls

Ductwork - Labor					
Pumps - Matls					
Pumps - Labor					
Water Treatment - Matls					
Water Treatment - Labor					
Isolation - Matls					
Isolation - Labor					
Pipe Flex - Matls					
Pipe Flex - Labor					
Sheet Metal - Matls					
Sheet Metal - Labor					
Duct Insulation - Matls					
Duct Insulation - Labor					
Pipe Insulation - Matls					
Pipe Insulation - Labor					
Pipe, Valves, Fittings - Matls					
Pipe, Valves, Fittings - Labor					
Misc. - Labor					
Misc. - Matls					
Insulation - Matls					
Insulation - Labor					
Sanitary Above Slab - Matls					
Sanitary Above Slab - Labor					
Storm Above Slab - Labor					
Storm Above Slab - Matls					
Gas - Matls					
Gas - Labor					
Fixtures - Matls					
Fixtures - Labor					
Permits					
VAV Boxes - Matls					
VAV Boxes - Labor					
Refrigerant Monitor - Matls					
Refrigerant Monitor - Labor					
Unit Heaters - Matls					
Unit Heaters - Labor					
Startup					
Controls					
Eng/Submittals					
Valves/Dampers - Matls					
Valves/Dampers - Labor					
Box Controls - Matls					
Box Controls - Labor					
Modules -Matls					
Modules -Labor					
End Devices - Matls					
End Devices - Labor					
Low Voltage Wiring - Matls					

Low Voltage Wiring - Labor
Startup/commissioning
Software Installation/Graphics upload to CFISD
server
Close-out Documents
Training
Punch List

Div. 26 - Electrical

Mobilization
Shop Drawings
As-Builts/Close-out/O&M Manuals
Underground - Matls
Underground - Labor
Conduit -Matls
Conduit - Labor
Wire - Matls
Wire - Labor
Feeder Wire - Matls
Feeder Wire -Labor
Switches/Recpt. Matls
Switches/Recpt. Labor
Switchgear - Matls
Switchgear - Labor
Temporary - Matls
Temporary - Labor
Gas Generator - Matls
Gas Generator - Labor
Fixtures - Matls
Fixtures - Labor
Low Voltage - Engineering/Submittals
Low Voltage Lighting- Devices - Matls
Low Voltage Lighting- Devices - Labor
Low Voltage Lighting - Wiring - Matls
Low Voltage Lighting - Wiring - Labor
Low Voltage Lighting - Programming/Start-up
Low Voltage Lighting- Training
Low Voltage Lighting - Close-out Documents
Voice System - Wiring - Matls
Voice System - Wiring - Labor
Video System - Trim-out - Matls
Video System - Trim-out - Labor
Video System - Testing
Master Clock - Matls
Master Clock - Labor
Close-out Documents
Punch List
Coordination Drawings

Div. 27 - Communications

Data System - Matls
Data System - Labor
Data System - Testing
Communications/PA - Control Panels - Matls
Communications/PA - Control Panels - Labor

Div. 28 - Electronic Safety and Security

Fire Alarm - Control Panel - Labor
Fire Alarm - Wiring - Matls
Fire Alarm - Wiring - Labor
Fire Alarm - Devices - Matls
Fire Alarm - Devices - Labor
Fire Alarm - Testing
Fire Alarm - Training
Fire Alarm - Close-out Documents
Security Systems - Submittals
Security Systems - Devices - Matls
Security Systems - Devices - Labor
Security Systems - Wiring - Matls
Security Systems - Wiring - Labor
Security Systems - Cameras Matls
Security Systems - Cameras Labor
Security Systems - DVR Equipment - Matls
Security Systems - DVR Equipment - Labor
Security Systems - Programming/Start-up
Security Systems - Training
Security Systems - Close-out Docs.
Video System - Close-out Docs

Div. 31 - Earthwork

Detention pond Final County inspection permit document
Demolition (as applicable)
Site Clearing & Grubbing
Earthwork - Matls
Earthwork - Labor
Finish Grading Matls
Finish Grading Labor
Stabilization Matls
Stabilization Labor
Site Drainage - Matls
Site Drainage - Labor

Div. 32 - Exterior Improvements

Chain Link Fence - Matls
Chain Link Fence - Labor
Paving - Matls
Paving - Labor

	Sidewalks - Matls					
	Sidewalks - Labor					
	Erosion Control - Matls					
	Erosion Control - Labor					
	Building Pad - Matls					
	Building Pad - Labor					
	Paving Subgrade					
	Signage/Striping					
	Bike Racks					
	Landscaping - Matls					
	Landscaping - Labor					
	Sod - Matls					
	Sod - Labor					
	Hydromulch - Matls					
	Hydromulch - Labor					
	Irrigation - Matls					
	Irrigation - Labor					
	Irrigation system testing/demonstration					
	Div. 33 - Utilities					
	Site Storm - Matls					
	Site Storm - Labor					
	Site Sanitary - Matls					
	Site Sanitary - Labor					
	U/G Fire Line - Matls					
	U/G Fire Line - Labor					
	Site Lighting - Matls					
	Site Lighting - Labor					
	Close-out Documents					
	Punch List					
	Alternates					
1						
2						
3						
4						
5						
	Allowances:					
	A. Owner's Betterment Allowance					

General Note: Close-out lists shall include As-builts, O&M's, Demonstration/Training, and any attic owner's stock.

END OF SECTION

SECTION 01 31 13

PROJECT COORDINATION

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 REQUIREMENTS

- A. General: notify the Architect whenever there is need of clarification or interpretation of the Contract Documents prior to commencement of work.
- B. Commencement of work without Architect's prior notification means Contractor's acceptance of responsibility.
- C. Commencement of work without Architect's prior notification implies Contractor's understanding of conditions, assemblies, methods, or procedures.
- D. The project superintendent shall notify the Owner on an ongoing basis of ongoing work.

1.2 PRE-INSTALLATION CONFERENCE

- A. General: Notify the Architect 48 hours in advance of certain stages of construction, and, as required by the Architect, organize a pre-installation meeting with each trade individually prior to commencement of their portion of the Work. At a minimum, representatives of the Architect, the General Contractor's project superintendent, and the Sub-contractor's Foreman and Project Manager shall be present at each meeting. The Engineer shall be notified as applicable.
- B. As indicated in each specific section of this Project Manual, or as required by the Architect, these stages generally include, but are not necessarily limited to the following:
 - 1. Division 2 - (Selective) Demolition.
 - 2. 05 50 00 - Miscellaneous metals, ladders, brackets, pipe rails, etc.
 - 3. Division 6 - Finish Carpentry and Millwork
 - 4. Division 7 - installation of waterproofing, vapor barriers, flashing and sheet metal.
 - 5. Division 7 - Installation of roofing system(s) and associated work.
 - 6. 07 21 00 - Concealment of insulation.
 - 7. Division 8 - Installation of doors, frames, windows, and storefronts.
 - 8. 08 71 00 - Installation of finish hardware
 - 9. Division 9 - Installation of plaster and gypsum board products.
 - 10. Division 9 - Installation of tile, flooring, and pavers.
 - 11. 09 51 00 - Installation of acoustical ceiling (grid and panels).
 - 12. 09 65 19 - Installation of resilient flooring and base.
 - 13. 09 91 00 - Painting and staining (each coat).
 - 14. Divisions 22, 23 and 26 - Completion of roughing-in of plumbing, heating, air conditioning and electrical work (prior to concealment).
 - 15. Division 23 - Installation of heating, ventilating and air conditioning.
 - 16. Division 26 - Installation of all electrical fixtures.
 - 17. Divisions 22, 23 and 26 - Any and all testing specified for equipment, mechanical, electrical and plumbing systems.
 - 18. 31 00 00 - Clearing and stripping of top soil within limits of grading.
 - 19. 31 00 00 - (Excavation and) Placing (of each lift of) select fill material, and site grading.
 - 20. 31 00 00, 31 23 23.13, and Divisions 22, 23 and 26 - Compaction, inspection, testing, and covering of underground utilities.
 - 21. Division 32 - Installation of site amenities, fencing, surfaces, landscaping, etc.

- C. In addition to notifying the Architect, notify the Structural Engineer (48 hours) prior to the following stages:
 - 1. Drilling, reinforcing, and placing of first piers and footings.
 - 2. Placing first reinforcing and grade beams.
 - 3. Erecting structural steel elements.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 PRE-CONSTRUCTION CONFERENCE

- A. The Contractor shall contact Architect at least ten (10) days prior to commencing construction in order for Architect to schedule a pre-construction meeting with Contractor, Architect, and Owner. This meeting must occur prior to commencement of any construction.

3.2 CONFERENCES AND MEETINGS

- A. Refer to Section 01 31 19, Project Meetings for requirements pertaining to Pre-construction Conference, Progress Meetings, and Pre-installation Conferences.

END OF SECTION

SECTION 01 31 19

PROJECT MEETINGS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDE

- A. The Architect will:
 - 1. Schedule each meeting (pre-construction conference, periodic project meetings, pre-installation meetings, and specially called meetings throughout the progress of the work).
 - 2. Prepare agenda for meetings.
 - 3. Preside at meetings, including all significant proceedings and decisions.
 - 4. record, reproduce, and distribute copies of meeting minutes within seven (7) days, excluding weekends and holidays, after each meeting to:
 - a. All participants in the meeting.
 - b. All parties affected by decisions made at the meeting.

- B. The Contractor shall:
 - 1. Make physical arrangement for meetings.
 - 2. Participate in all meetings and conferences.
 - 3. Schedule attendance of Job Superintendent, Project Manager, and other parties affecting or affected by decisions made at meetings and conferences as their interests require.
 - 4. Provide updated schedules.
 - 5. Provide status reports/logs of RFIs, CPRs, MCs, and shop drawings/submittals.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 PRE-CONSTRUCTION CONFERENCE

- A. Architect will:
 - 1. administer pre-construction conference for the establishment of communication methods, procedures and Owner requirements.
 - 2. administer site mobilization conference for clarification of Owner and Contractor.

- B. Location: At Project site or as designated by the Architect.

- C. Attendance:
 - 1. Contractor or Contractor's Representative
 - 2. Job Superintendent
 - 3. Project Manager
 - 4. Owner or Owner's Representative
 - 5. Major subcontractors
 - 6. Major suppliers
 - 7. Architect's Representative
 - 8. Consultants as needed
 - 9. Third-party Consultants
 - 10. Others as appropriate

- D. Meeting Agenda, may include, but is not limited to:
 - 1. Discussion on major subcontracts and suppliers and projected construction schedules.
 - 2. Critical work sequencing.
 - 3. Major equipment deliveries and priorities. Discussion of long lead time items.
 - 4. Project coordination and designation of responsible personnel.
 - 5. Procedures and processing of field decisions, proposal requests, requests for information (RFIs), submittals, minor changes, change orders and applications for payment.
 - 6. Method of distribution of contract documents.
 - 7. Procedures for maintaining record documents.
 - 8. Use of premises, office work and storage areas, on-site parking, and owner's requirements.
 - 9. Construction facilities and temporary utilities.
 - 10. Housekeeping procedures.
 - 11. Special owner requirements (specifications sections 01 35 23, 01 35 23.1 and 01 35 23.2)
 - 12. Lien release requirements

3.2 PRE-DEMOLITION CONFERENCE

- A. Owner will:
 - 1. Administer pre-demolition conference for the establishment of communication methods related to demolition procedures and Owner coordination and scheduling requirements for demolition scope.
- B. Location: At Project site or as designated by the Architect.
- C. Attendance:
 - 1. Contractor or Contractor's Representative
 - 2. Job Superintendent
 - 3. Project Manager
 - 4. Owner or Owner's Representative
 - 5. Major Subcontractors
 - 6. Demolition Subcontractors
 - 7. Architect's Representative
 - 8. Consultants as needed
 - 9. Third-Party Consultants
 - 10. Others as appropriate
- D. Meeting Agenda, may include, but is not limited to:
 - 1. Discussion on projected demolition schedules.
 - 2. Procedures for coordination of demolition sequencing and scheduling.
 - 3. Procedures for coordination associated with existing building components need to be returned to Owner.
 - 4. Project demolition coordination and designation of responsible personnel.
 - 5. Procedures for maintaining record documents.
 - 6. Special owner requirements (specifications section 01 36 13).

3.3 PROGRESS MEETINGS

- A. Architect will:
 - 1. Schedule project meetings throughout progress of the work at intervals to be determined.
 - 2. Set agenda and administer said meetings.
 - 3. Preside over meetings.
 - 4. Record meeting minutes, including all significant proceedings and decisions.
 - 5. Reproduce and distribute copies of meeting minutes within seven (7) days, excluding weekends and holidays, after each meeting to:
 - a. All participants in the meeting.
 - b. All parties affected by decisions made at the meeting.

- B. Contractor shall:
 - 1. Make physical arrangements for meetings.

- C. Attendance:
 - 1. Contractor or Contractor's Representative
 - 2. Job Superintendent
 - 3. Project Manager
 - 4. Owner or Owner's Representative
 - 5. Major subcontractors
 - 6. Architect's Representative
 - 7. Consultants as needed
 - 8. Others as appropriate

- D. Meeting Agenda, may include, but is not limited to:
 - 1. Review and approval of minutes of previous meeting.
 - 2. Review of work progress since previous meeting.
 - 3. Field observations, problems, and conflicts.
 - 4. Review of off-site fabrication and delivery schedules.
 - 5. Corrective measures and procedures to regain projected schedule.
 - 6. Review three week "look-ahead" construction schedule.
 - 7. Maintenance of quality standards.
 - 8. Response to request for information (RFIs) and status of outstanding RFIs.
 - 9. Status of submittals.
 - 10. Status of CPRs.
 - 11. Status of MCS.
 - 12. Other items and critical issues affecting work.

3.4 PRE-INSTALLATION CONFERENCES

- A. Architect will convene a pre-installation conference, when required in individual specification Section, prior to the Contractor commencing Work of the Section. The Contractor will produce agenda, Architect will distribute copies of the pre-installation conference minutes within seven (7) days, excluding weekends and holidays, after each conference to all participants in the meeting, the Owner and all parties affected by decisions made at the meeting.

- B. Attendance:
 - 1. Contractor's Superintendent(s)
 - 2. Subcontractor's Foreman
 - 3. Contractor's Project Manager(s)
 - 4. Architect's Representative
 - 5. Consultants as needed
 - 6. Owner or Owner's Representative
 - 7. Manufacturer's Representative
 - 8. Others affecting or affected by Work.
 - 9. Third party inspectors

- C. Meeting Agenda, may include, but is not limited to:
 - 1. Review of conditions of installation.
 - 2. Preparation and installation procedures.
 - 3. Coordinate with related work
 - 4. Review of the contract document requirements.
 - 5. Questions related to work required.
 - 6. Mockup samples or panels

3.5 MONTHLY PAY APPLICATION REVIEW MEETINGS

- A. The Owner, Architect, and Contractor shall schedule and conduct monthly Pay Application review meetings during the entire duration of construction prior to the submission of the notarized completed Contractor Application for payment to the Architect for certification. The Contractor shall produce a draft of the proposed Application for Payment for review by the Owner and Architect. The Contractor shall include and furnish the following documents for review:
 - a. Draft of the Contractor's Application for Payment (AIA Document G702)
 - b. Invoices for any stored materials included in the Application. Invoices shall include full descriptions and costs as required to facilitate on-site review
 - c. Release of Liens from Subcontractors and Sub-subcontractors for all work billed in previous certified Applications for Payment.
 - d. Owner reserves the right to require Release of Liens for any previously submitted notice of claim submitted by any Subcontractor, Sub-subcontractor, or suppliers.
 - e. Evidence of payment for any and all backcharges, overtime, etc. previously issued by Owner that would be past due by the time payment is made by Owner.
 - f. Pay Application review checklists fully completed.
 - g. Updated project schedule
 - h. Owner may withhold payment on line items for which a lien or claim (or similar notice of intent) has been filed, until satisfactory release has been received and accepted by Owner.
- B. Attendance:
 - a. Owner's representative
 - b. Architect
 - c. Contractor
 - d. Subcontractors as appropriate
- C. Meeting agenda may include, but is not limited to:
 - a. Review percentages of work completed and being billed to date.
 - b. Review of any stored materials being billed to date and all associated surety recommendations
 - c. Review of lien releases, notices of claims, etc.
 - d. Confirmation of approved CPRs
- D. The meeting date shall be determined by the Architect, Contractor, and Owner, and shall occur on that same date each month.

3.6 SAMPLE MEETING AGENDA

Refer to the following pages for a sample Pre-Construction Meeting agenda.

3.7 SUBMISSION OF FINALIZED APPLICATION FOR PAYMENT

Refer to AIA Document A201TM-2017, as amended, Article 9.

SAMPLE PRECONSTRUCTION MEETING AGENDA:

**PROJECT NAME
CYPRESS-FAIRBANKS INDEPENDENT SCHOOL DISTRICT**

**CYPRESS-FAIRBANKS I.S.D. BID NUMBER:
PRE-CONSTRUCTION CONFERENCE**

AGENDA

Date:

Time:

Location: Cypress-Fairbanks Independent School District
Facilities and Construction Office
11430 Perry Road
Houston, Texas 77064

I. INTRODUCTION OF PERSONNEL

- | | | | |
|----|------------------------|--------------------------|----------------|
| A. | OWNER: | Cypress-Fairbanks I.S.D. | (281) 897-4108 |
| 1. | Name | Title | Phone Number |
| B. | ARCHITECT: | | |
| 1. | Name | Title | Phone Number |
| C. | CONTRACTOR: | | |
| 1. | Name | Title | Phone Number |
| D. | THIRD PARTY INSPECTORS | | |
| 1. | Name | Title | Phone Number |

II. REVIEW CONSTRUCTION GUIDELINE REQUIREMENTS

III. SUB/TRADE START-UP MEETINGS

IV. REVIEW CONSTRUCTION PROGRESS MEETING PROCEDURES

V. SPECIAL OWNER REQUIREMENTS

VI. DOCUMENTS MODIFYING AND/OR CLARIFYING THE CONTRACT

- A. Minor Change Form
- B. Change Proposal Request Form
- C. Clarification
- D. Construction Change Directive
- E. Warranty Work Request
- F. Change Order Form
- G. Claims for additional time since last meeting (weather delays, etc.)

VII. SCHEDULE, SITE OPERATIONS SET-UP AND MOBILIZATION

VIII. DISCUSSION

IX. LIEN RELEASE LOG AND BACKCHARGE LOG REVIEW

X. CLOSEOUT REQUIREMENTS

MEETING ADJOURNMENT

PROJECT:

CONSTRUCTION GUIDELINE REQUIREMENTS

The Construction Guideline Requirements supplement the project documents and procedures established for the cooperation and coordination between the Contractor, Architect, and related activities scheduled throughout the construction project.

I. RECORD DOCUMENTS AT JOB SITE

- A. The Contractor shall maintain throughout the construction of the project a record set of documents at all times secured to the document table. These plans shall be updated to reflect any changes to the original drawings. Field clarifications, minor changes, addenda, and change orders are to be posted and/or noted on these drawings to document the actual project record conditions.
- B. The Contractor, at all times, shall maintain a record set of project specifications reflecting the information noted in Item 01.

II. TESTING PROCEDURES

- A. The Testing Laboratory shall be scheduled through the General Contractor to monitor the soils, concrete, rebar, structural steel, and other testing services required throughout the project. The General Contractor will be required to provide a 48-hour advanced notice to the testing laboratory for scheduled inspections.
- B. Concrete pours shall be scheduled by the General Contractor 48 hours in advance of the scheduled pour. The General Contractor will be responsible for scheduling both Architect's representative and the testing laboratory for observation and testing of the scheduled concrete pour. Unless prior approval has been arranged, all concrete pours are to be made in the presence of the testing laboratory and/or Architect's representative, following their review of all reinforcing steel and miscellaneous items.

III. FIELD INSPECTIONS

- A. Mechanical, Electrical, and Plumbing inspections shall be in compliance with the contract documents. Excavation, materials, installation, backfill, and cover-up shall be reviewed by a representative from Architect, the Owner, and/or an outside consultant in the required sequences for each scheduled activity. The General Contractor will be required to provide a 24-hour advance notice for each scheduled activity to be reviewed.

IV. SUBMITTALS

- A. Shop Drawings and/or submittals shall be submitted to the Architect in the required quantities (re: specs), with the Contractor's stamp affixed to all items and signed by the Contractor signifying he has reviewed each submittal and it meets exceeds all Contract requirements. Shop drawings or submittals not containing this information will be returned not approved. Commencement of work without reviewed and approved shop drawings will not be permitted. The Contractor will provide a list of shop drawings and/or submittals within 1 month of contract award noting the critical and/or priority items requiring immediate review and approval. Dates for submission of all items will also be provided. A complete set of shop drawings shall be maintained at the field office and their status reviewed at each construction progress meeting.

V. CHANGES IN THE WORK

- A. Change Requests involving additions, deletions, and/or revisions to the contract documents must be submitted by the Contractor to Architect's office in writing accompanied by an itemized material, labor, and equipment breakdown for review and approval prior to any changes occurring. Response to all minor changes and proposal requests must be submitted to Architect within 20 days for review and response.

VI. LIST OF SUBCONTRACTORS

- A. A list of each Subcontractor scheduled to perform work on the project should be submitted to Architect at the start of the project with Schedule of Values and before review of the first Application for Payment. (Use AIA Document G805)
- B. Prior to the commencement of work by each Subcontractor, a meeting will be scheduled to review the requirements, materials, and/or equipment specified in the contract documents.

VII. SCHEDULE OF VALUES

- A. The Schedule of Values shall be approved by Owner and Architect prior to submitting the first pay application. This Schedule shall include the monetary values for each item of construction, breaking out the labor and material for each activity. (Use AIA Documents G702 and G703)

VIII. PROGRESS SCHEDULE

- A. Progress Schedules shall be approved by Owner and Architect prior to submitting the first pay application. This schedule shall be a graphical projection of construction activities subdivided into various components and outlining the anticipated starting and completion dates. Indicate the "critical path" items and update the schedule monthly and recovery if required.

IX. CONTRACTOR'S APPLICATION FOR PAYMENT

- A. Pay applications will be reviewed monthly at the project site. The pay application will be in a preliminary draft for the review by Architect's and the Owner's representative. The reviewed, accepted, and/or modified pay application will be submitted to Architect's office for processing. Affected subcontractors and/or material suppliers are requested to be present at each pay application review. Progress schedules are to be revised and updated monthly and submitted with each preceding application for payment.
- B. Stored materials are required to be in accordance with Section 9.3.2.

X. PROGRESS MEETINGS

- A. Progress meetings will be held to discuss job progress, coordination, schedule, and anticipated conflicts. Those in attendance will be the Owner, Architect, General Contractor, affected subcontractors, and/or particular consultants. Frequency of the progress meetings will be determined by job conditions. The Architect will keep accurate minutes of the meetings and distribute copies to all in attendance.

XI. LINES OF COMMUNICATION

- A. The Architect is the Owner's representative and all communications between the Owner and General Contractor shall be channeled through the Architect. Subcontractors shall correspond with the Owner and/or the Architect through, or in the presence of, the General Contractor.
- B. The Superintendent shall be fully knowledgeable of the contract documents. Review and approval by the Superintendent of all items prior to observations by the Architect and/or Owner's representative is essential in avoiding project delays and re-inspection of nonconforming work.

XII. ADDITIONAL SERVICES

- A. Additional architectural or engineering services and testing or retesting to analyze and inspect nonconforming work shall be at the Contractor's expense.

XIII. APPROPRIATE CONDUCT

- A. Appropriate conduct and language must be exercised by all construction workers. Appropriate clothing must be worn at the job sites by all workers. Misconduct involving a worker will constitute immediate dismissal and removal of said worker from the project site.
- B. The Contractor shall comply with all Special Owner Requirements per Specification Section 01 35 23 herewithin.

XIV. SUBSTITUTIONS

- A. Substitutions not approved prior to proposal will not be considered.

XV. SUBSTANTIAL COMPLETION AND CLOSE OUT

- A. The General Contractor shall submit in written form a list of items requiring completion (per contract requirement) and/or correction along with a written request for substantial completion.
- B. The General Contractor shall submit all of the required documents, information, and materials to the Architect to expedite project close-out as outlined in the Project Close-Out Specifications.

PROJECT:

CONSTRUCTION TRADE START-UP MEETING GUIDELINES

The Architect shall direct the General Contractor to arrange a time and location 48 hours prior to a new trade commencing work for the purpose of reviewing and discussing the project documents and specifications governing the particular Subcontractor's work.

The reviews should include, but not be limited to, the following:

1. Determine if all appropriate shop drawings, samples, and/or literature has been submitted, reviewed, and approved.
2. Determine if the Subcontractor has all the current documents to begin and complete his work in compliance with the contract.
3. Inform the Subcontractor/Foreman that if inspections will be needed, the Contractor must provide the Architect with a 48-hour advance notice.
4. Review with the Contractor and Subcontractor any storage or temporary staging areas required and whether there will be conflicts with other trades.
5. Determine if Subcontractor/Foreman has knowledge of what area his work will commence and the sequence to be followed.
6. Examine thoroughly each part and section of the specifications, noting materials, workmanship, manufacturer's recommendations, installation, etc.
7. Alert the Contractor and Subcontractor to special conditions outlined in the project documents and/or project specifications required by the Architect, Owner, or related Consultants.
8. Emphasize that clean-up is a very important item in the overall construction of the project and that an unsightly project will not be tolerated.
9. Inquire if there are any questions relating to the specific areas covered or questions about areas not specifically covered.
10. Review coordination drawings required by Contract.

PROJECT:

JOB PROGRESS MEETING GUIDELINES

The Architect shall consult with the Owner's representative to determine at what intervals progress meetings will occur. The Architect shall inform the General Contractor of the time, date, and locations of the Construction Progress Meetings and the regularity of the proposed scheduled meetings.

ARCHITECT

1. The Architect shall prepare a Record of Attendance sign-in sheet for those attending the progress meeting.
2. The Architect shall preside over the order of the meeting. The Architect shall then recognize the General Contractor's representative, who will address the items outlined under the Contractor.
3. Following the completion of the Contractor's agenda, comments will be received and/or offered by the Owner, Architect, Contractor, and any member in attendance at the progress meetings.
4. The Architect shall submit to the Owner and Contractor notes describing the accounts of the progress meeting, including the time, date, and location of the next scheduled meeting.
5. The Architect, upon reviewing the previous meeting minutes with the Owner and General Contractor, shall amend, add to, or accept as submitted. The meeting notes will then be mailed to the Owner and Contractor for their record copy of the accepted meeting notes.

CONTRACTOR

1. The Contractor, at the beginning of each progress meeting, shall submit an agenda outlining those scheduled to attend, an updated progress schedule, and any other matters of interest requiring discussions and/or immediate response affecting the overall construction progress.
2. The progress meetings shall be attended by the Project Manager, Field Superintendent, representatives from trades in progress or trades to begin work prior to the next scheduled meeting. Materials suppliers and/or other representatives impacting the current or near-current construction schedule shall also be in attendance.
3. The Contractor shall review and update the construction schedule by noting progress, work in progress, and anticipated work to begin. Areas of delays in deliveries, materials, equipment, manpower, utilities, pending architectural responses, and/or pending Owner responses that may affect the construction progress shall be addressed in conjunction with the construction progress schedule.

END OF SECTION

SECTION 01 31 29

NOTIFICATION OF ARCHITECT REQUIREMENTS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 REQUIREMENTS

- A. In general, the Contractor shall notify the Architect whenever there is need of clarification of interpretation of the Contract Documents.
- B. The Contractor shall notify the Architect 48 hours in advance of certain stages of construction. The project superintendent shall notify the Owner's Representative on an ongoing basis of ongoing work. These stages shall include, but are not necessarily be limited to the following:
1. Division 2, Division 31 - Clearing of site.
 2. Div 31-33 - Stripping of top soil within limits of grading.
 3. Div 31-33 - (Excavation and) Placing (of each lift of) select fill material.
 4. Div 31-33 - Compaction, inspection, testing, and covering of underground utilities.
 5. 31 63 29 - Drilled and reamed foundation piers.
 6. 31 23 00 - Excavation of grade beams.
 7. 03 30 00, 04 22 13 - Placing of concrete.
 8. 07 81 00 - Concealment of insulation.
 9. 07 84 00 - Installation of firestopping and firesafing.
 10. 07 52 19 - Modified Bitumen Membrane Roofing System
 11. 07 92 00 - Installation of building and glazing sealants.
 12. 08 80 00 - Installation of glazing and glazed systems.
 13. 09 21 16 - Installation of gypsum wallboard.
 14. 09 30 13 - Installation of ceramic tile.
 15. 09 51 00 - Installation of acoustical ceiling (grid and panels).
 16. 09 65 19 - Installation of resilient flooring and base.
 17. 09 68 00 - Installation of carpeting.
 18. Division 09 - Painting and staining (each coat), Elastomeric coatings, etc.
 19. Division 02 - Abatement work
 20. Division 23 - Installation of heating, ventilating and air conditioning system.
 21. Division 23 - HVAC system startup
 22. Division 22 - Installation of plumbing fixtures.
 23. Divisions 21-26 - Any and all testing and training specified for equipment, mechanical, electrical and plumbing systems.
 24. Divisions 21-26 - Completion of roughing-in of plumbing, heating, air conditioning and electrical work (prior to concealment).
 25. Division 26 - Initiation of permanent power
 26. Division 26 - Installation of all electrical fixtures.
 27. Division 27-28 - Installation of all data, low voltage, security, special systems, fire alarm, and misc. technology systems.
 28. Notify the Architect and the Owner: All pre-construction or trade startup meetings.
 29. Owner shall be given notification/opportunity to conduct inspections prior to wall or ceiling cover up.
- C. In addition to notifying the Architect, the Contractor shall also notify the Structural Engineer (48 hours) prior to the following stages:
1. Drilling, reinforcing, and placing of first piers and footings.
 2. Placing first reinforcing and grade beams.
 3. Erecting structural steel elements.

- D. Above ceiling inspections shall be completed prior to cover up. All systems are to be reviewed at the same inspection. All systems shall be 100 percent complete prior to inspection.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 PRE-CONSTRUCTION CONFERENCE

- A. The Contractor shall contact Architect at least ten (10) days prior to commencing construction in order for Architect to schedule a pre-construction and/or trade startups meeting with Contractor, Architect, Owner, and third-party firms. This meeting must occur prior to commencement of any construction.

3.2 CONFERENCES AND MEETINGS

- A. Refer to Section 01 31 19, Project Meetings for requirements pertaining to Pre-construction Conference, Progress Meetings, and Pre-installation Conferences.

END OF SECTION

SECTION 01 32 16

CONSTRUCTION PROGRESS SCHEDULE

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Instructions to Proposers for substitutions.

1.2 SUBMITTALS

- A. Schedules:
 - 1. Preliminary Analysis: Within fourteen days after receipt of Notice to Proceed, submit a preliminary construction schedule for review.
 - 2. Construction Schedule: Within four weeks after receipt of Notice to Proceed, submit one reproducible and four prints of the construction schedule.

1.3 RELIANCE UPON SCHEDULE

- A. The construction schedule as approved by the Architect will be an integral part of the Contract, and will establish conditions for various activities and phases of construction.

PART 2 - PRODUCTS

2.1 CONSTRUCTION SCHEDULE

- A. Diagram: Graphically show the order of all activities necessary to complete the work and the sequence in which each activity is to be accomplished.
- B. General Requirement:
 - 1. Contractor shall provide a completed Project Schedule as outlined below 14 days after Contract Award for review and comment by Owner and Architect
 - 2. Activities shown on the schedule shall include, but not necessarily be limited to:
 - a. Project mobilization.
 - b. Submittals and approvals of shop drawings and samples.
 - c. Phasing of construction.
 - d. Procurement of equipment and critical materials.
 - e. Fabrication and installation of special material and equipment.
 - f. Final clean-up.
 - g. Final inspection and testing.
 - h. Air and water balancing.
 - i. Demonstrations for Owner and Owner's staff.
 - j. Punch lists.
 - k. Project closeout.
 - l. Commissioning Schedule
 - 3. The project Schedule shall be divided by trade/spec section and by area of the building with each section to include such items as material delivery dates, below-grade finish/install, above-grade finish/install, trimout, etc. Detail to include specific components of the trade being scheduled (for example: painting would show clean/prep. Block fill, first coat, finish coat, etc.).
 - 4. Project Schedule shall include the amount of anticipated weather days allocated for the Project at the appropriate months, and should also include such milestones as permanent power, chiller startup, etc. where applicable.

5. Contractor shall complete the subcontract trades buyout process 30 days after the Contract award.
6. Contractor shall ensure that all required submittals are submitted for review no later than 60 days after Contract award.
7. Project schedule shall be initially scheduled to allow Initial Completion 60 days prior to Substantial Completion. The 60-day period between Initial Completion and Substantial Completion shall be allocated for such items as the following:
 - a) *Initial Final Clean*
 - b) *Trial owner's systems testing*
 - c) *Owner's tests and inspections*
 - d) *Owner's systems demonstrations*
 - e) *Establishment of required stand of grass*
 - f) *Correction of Contractor's punch list*
 - g) *Owner/Architect punch list*
 - h) *Correction of Owner/Architect punch list*
 - i) *Final clean to deliver building after all tests and inspections*
 - j) *Substantial Completion*
 - k) *Test and Balancing*
 - l) *Commissioning*
8. Schedule shall also include a review of O&M manuals 30 days prior to Substantial Completion and shall include submission of a closeout document binder mock-up.

2.2 CONSTRUCTION SCHEDULE LIMITATIONS

- A. Work performed under this Contract shall be performed in accordance with the following paragraphs so that the Owner can accept the project as substantially complete as noted below.
- B. The project schedule begins upon Notice to Proceed and continue uninterrupted with the following requirements:
 1. The entire project shall be substantially complete by dates noted in the Standard Form of Agreement between Owner and Contractor (AIA Document A101™-2017, as amended) subject to Liquidated Damages as listed in General Conditions of the Contract for Construction as amended (AIA Document A201™-2017, as amended) and Supplemental Conditions (Section CB).
- C. Certificates of Substantial Completion may be issued for any of the above mentioned areas of work which are complete prior to the completion of the entire project, provided that all contract requirements for Substantial Completion are met for that portion of the Work. However, warranties shall commence on date of Substantial Completion of entire project. Maintenance required by equipment manufacturers shall be performed by Contractor through the agreed-upon Substantial Completion date, unless specified otherwise in the Contract Documents.
- D. For work during Summer: Any construction related activities after (Last Day of School) and before the start of the next school year, must occur during CFISD normal working hours of Monday through Thursday (10-hour days) or the contractor must request and pay for overtime request to have the building open per Special Owner Requirements Section 01 35 21.1. This requirement will also apply to any work during the school year outside the normal CFISD working hours. The 4-day/10-hour day schedule will only be applicable during scheduled summer break.

END OF SECTION

SECTION 01 33 00

SUBMITTALS

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Section AB for substitutions.

1.2 PROCEDURES

- A. Transmit each item with approved form identifying project, contractor, subcontractor, major supplier; identify pertinent drawing sheet and detail number and specification section number, as appropriate. Identify deviations from Contract Documents.
- B. Apply Contractor's stamp, signed, to each item submitted, certifying that review and verification of products, field dimensions, adjacent construction work and coordination of information is in accordance with the requirements of the work and Contract Documents.
- C. Revise and resubmit submittal as required; identify all changes made since previous submittal.
- D. After review, distribute copies to all concerned parties.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- A. Refer to AIA Document A201™-2017, General Conditions of the Contract for Construction; as amended, 3.12.13 for the number of copies required. Transmit Consultant and Engineering submittals directly to respective consultants with a transmittal to the Architect.
- B. The Contractor shall provide composite drawings within 4 weeks of Notice To Proceed, showing how all piping, ductwork, lights, conduit, and equipment, etc. will fit into the ceiling space allotted, including clearances required by the manufacturer, by Code, or in keeping with good construction practice. Space for all trade elements must be considered on the same drawing. Drawings shall be 1/4 inch per foot minimum scale and shall include invert elevations and sections required to meet the intended purpose.
- C. Manufacturer's Instructions: When work is specified to comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including two copies to Architect at least two weeks prior to start of such work.
- D. All dimensions indicated on the drawings are based on the specific models and manufacturers of products, equipment, fixtures, and miscellaneous items specified. If the Contractor uses an approved product by another listed manufacturer which is different than the specific model and manufacturer listed in these specifications, then the Contractor shall be solely responsible for the coordination of any dimensional changes required, including structural, relocation of walls, equipment, fixtures, ceilings, and miscellaneous items. When dimensional changes are required in these situations, the Contractor shall submit a proposed modification drawing to the Architect for approval prior to proceeding with the work. All causes and effects of the dimensional change shall be indicated on the Contractor's drawing submittal.

1.4 SAMPLES

- A. Submit full range of manufacturer's standard colors, textures, and patterns for Architect's selection. Submit samples for selection of finishes in accordance with approved schedule, and in such sequence as to cause no delay in the work or in the work of any other Contractor. All color samples to be physical samples, not digital unless requested by Architect.

- B. Submit samples to illustrate functional characteristics of the product, with integral parts and attachment devices. Coordinate submittal of different categories for interfacing work.
- C. Submittals shall contain:
 - 1. Date of submission and dates of any previous submissions
 - 2. Project title and number
 - 3. Contract identification
 - 4. Names of Contractor, Supplier, Manufacturer
 - 5. Identification of sample, with specification section number
 - 6. Note any deviation from contract documents
- D. Resubmission Requirements for Samples:
 - 1. Make any corrections or changes in the submittals required by the Architect and resubmit until approved.
 - 2. Submit new samples as required for initial submittal.
- E. Submit the number specified in the respective Specification section; minimum of two, one will be retained by Architect. Reviewed samples may be used in the work if so indicated in the specification section.

2. MANUFACTURER'S CERTIFICATES AND WARRANTIES

- A. Submit required certificates and warranties in duplicate.

END OF SECTION

SECTION 01 35 23

SPECIAL OWNER REQUIREMENTS

This Section has been added to identify and reinforce specific items that are currently defined in depth in the specifications, and that are of great importance to Cypress-Fairbanks Independent School District. The Owner of the Construction Company making an offer on the project must sign this document and an original, notarized copy will be attached to the Construction Contract.

1. **Substantial Completion: Refer to the General Conditions of the Contract for Construction as amended, Paragraph 9.8.**
2. **Documentation of Existing Conditions**
 - a. Conditions of improvements (roads, landscape areas, signage, building exterior and interior, etc.) at the building site where work is scheduled to occur are considered to be in good condition. The Contractor shall document through the use of digital video, any existing defects in areas where work will actually be performed, including but not limited to, staging areas and areas of circulation around the site, prior to the start of any construction. Contractor shall also test and document building and site systems (fire alarm, sound, irrigation, etc.) These systems are considered to be in good operating condition unless documented otherwise. A copy of all digital video (flash drive) must be filed with the Owner prior to the start of any construction. Any and all defects not specifically identified prior to construction shall be repaired/replaced by the contractor to the satisfaction of the Owner, at no additional cost.
3. **Application for Payment:**
 - a. Pay application(s) must be correctly completed and executed by the Contractor. All numerical columns and tabulations should be correctly totaled to the nearest cent. With each pay application, Contractor shall also submit partial lien releases from all sub-contractors and major suppliers on the form included in this Project Manual, for work performed through the previous accounting period, an updated construction schedule and construction progress photographs. All lien notices received by the Owner from the previous pay period must be cleared by submission of an unconditional release of lien prior to submission and approval of current applications for payment. Noncompliance with these requirements will result in the return of the Application for Payment(s) to the Contractor for correction and resubmittal. Final application for payment shall only be submitted to the Owner upon completion of all close out requirements including but not limited to receipt of Record Documents, Operation and Maintenance Manuals, Owner Orientation and Training Meetings, Consent of Surety, Contractor Final Release of Lien, Contractor's Affidavit of Payment of Debts and Claims, and unconditional final lien releases from all subcontractors, sub-subcontractors and major suppliers and any other closeout requirements per the contract documents.
 - b. **If errors are discovered by the Owner in certified applications for payment, the Owner shall reject the application and return it to the contractor for correction. The specified time period for payment of such applications will start over on the date the Owner receives the corrected certified application for payment from the Architect.**
4. **Construction Schedule:**
 - a. Refer to Section 01 32 16. The Contractor shall provide a detailed construction schedule at the start of the project and shall submit an updated schedule at the weekly construction meetings. This schedule will also identify the estimated percentage of work completed to date for each item of work along with percentage of work remaining to be completed. This information will be used in the verification of the Contractor's Application for Payment. Application for Payment will not be reviewed, approved, and processed without submittal of the initial schedule and subsequent updated schedules throughout the duration of the project.

5. Use of Alcohol and Tobacco Products:

- a. Smoking and the use of all tobacco and alcohol products are prohibited at all times on Cypress-Fairbanks ISD property, including the field office. The Contractor will be fined \$250.00 for each infraction of this policy. In addition, the Owner reserves the right to have the Contractor's personnel dismissed from the District property. This policy is strictly enforced by all employees of Cypress-Fairbanks ISD.

6. Reinspection Fees:

- a. During the course of the project, should additional inspections be required by the Owner or Consultants to review problems directly created by and attributable to the Contractor, then all associated expenses including mileage shall be deducted from funds remaining to be paid to the Contractor. The Owner or Architect will verbally inform the General Contractor of the intent to request additional reinspection fees at the time of the occurrence and will provide written invoicing within thirty (30) working days after the date of the occurrence.

7. Job Superintendent:

- a. The Contractor will be required to keep the job superintendent on the job site full-time during the course of the job until completion of all punch list items. In the event the job superintendent is absent from the job site at any time during the project contract time or during punch list completion and a previously agreed upon substitute is not provided, the Owner may fine the Contractor \$250.00 per occurrence.
- b. The Owner is to be notified at the beginning of the workday if the job superintendent is out sick. If the superintendent is out for any other reason, the Owner is to be notified at least twenty-four (24) hours in advance. In both cases, the Owner is to be informed of the name of the acting job superintendent.
- c. Subcontractors, Sub-subcontractors are not allowed to work unsupervised on the jobsite at any time during the performance of the work including overtime and weekends.
- d. Where multiple sites are part of the construction contract, the Contractor shall furnish a full-time superintendent for each project campus work is to be performed unless otherwise specified or agreed to by the Owner.

8. Site/Building Rules and Regulations

- a. The Contractor shall adhere to the following building rules and regulations during the performance of the work within this contract. The Owner will back charge the Contractor in the amount of \$250.00 per occurrence for any violations of any of these rules and regulations. In addition, the Owner reserves the right to remove the person committing the violation permanently from the project site.
 1. No foul language or spitting will be allowed on district property and within the interior of the buildings.
 2. The possession of tobacco products, firearms, alcohol, or illegal drugs is strictly prohibited on school property and is a state and federal law and subject to criminal charges for any such violation.
 3. Workers must be fully clothed. Shorts and tank tops are not allowed on school property.
 4. The Contractor's personnel shall demonstrate professional behavior and respect toward all school district personnel and property. Physical, verbal, or visual contact with students is strictly prohibited.
 5. Any worker with a history of felony convictions or warrants is strictly prohibited from working on district property. The District has the right to perform criminal checks on any worker the Contractor and/or its subcontractors proposes to use on the project prior to

- issuance of security identification badges. The Owner reserves the right to check such records anytime during construction if the Owner deems it necessary for the safety and protection of the students and staff.
6. The Contractor's personnel are not allowed to park on any grass area, under shade trees, sidewalks, or non-vehicular paved areas. The Contractor will be held liable for any resultant damages resulting from the violation of this requirement.
 7. Authorization must be obtained in advance with the campus administrator or the Facilities Planning and Construction Department to enter or access any existing facility campus.
 8. The Contractor, subcontractors or sub-subcontractors shall keep the premises and site free from accumulation of waste, materials or rubbish caused by the work under this contract at each site. Boxes must be broken down prior to removal from the building. Upon completion of the contract work, and prior to the final inspection, have the premises in a neat and clean condition.
 9. The Contractor shall take all precautions necessary for the safety of, and provide protection to prevent damage, injury or loss to:
 - a. All employees on the project and all other persons who may be affected thereby.
 - b. All the work with all the materials to be incorporated therein, whether in storage on or off the site.
 - c. All property at the site and adjacent thereto including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and any other school property.
 10. A competent supervisor who understands the full scope of the work shall be on-site at all times while work is being performed and remain on-site until all punch list items have been completed as specified here within this specification section.
 11. The Contractor shall be responsible to Cypress-Fairbanks I.S.D. for acts and omissions of the Contractor's employees, subcontractors and their agents and employees, and other persons performing portions of the work under the contract.
 12. The Contractor shall not perform any work within the confines of a secured building on a renovation/addition project or after Substantial Completion on a new Project without the District having one District custodian present during performance of the work. The contractor must reimburse Cypress-Fairbanks I.S.D. Operations Department for the overtime costs associated with the after-hours work as specified within this specification section. Refer to Special Owner Requirements Overtime Section 01 35 23.1.
 13. All exterior doors must be kept closed at all times.
 14. All workers must wear badges at all times when on CFISD property. Refer to Special Owner Requirements Badging Section 01 35 23.2
 15. All deliveries shall be received and signed for by the Contractor and not by Cypress-Fairbanks ISD personnel. The Contractor shall post signs, in a location agreed upon by the Owner's Representative, stating where deliveries are to be received and who is to sign for them.

Signature form follows on next page.

By signature of this document, I hereby state that I (or designated representative of this Company as indicated below) have reviewed the project sites, reviewed the Contract Documents, and read the Specifications including the General Conditions as Amended, Supplementary Conditions and Special Owner Requirements in their entirety and do fully understand and agree to fully abide by all requirements established herein.

Respectively Submitted,

By: _____
Signature

Printed Name

Title

Company Name

Street Address

City, State, Zip Code

(Seal - if Proposer is a Corporation)

Date _____ State of _____ County of _____

Subscribed and sworn to before me this _____ day of _____

Notary Public:

My Commission expires:

NOTE: Form must be notarized and attached to the Construction Contract.

END OF SECTION

SECTION 01 35 23.1

**BUILDING OVERTIME REQUESTS
SPECIAL OWNER REQUIREMENTS**

This Section has been added to identify and reinforce specific items that are currently defined in depth in the specifications, and that are of great importance to Cypress-Fairbanks Independent School District. The Owner of the Construction Company making an offer on the project must sign this document and an original, notarized copy will be attached to the Construction Contract.

Contractor Overtime and Building Access

- A. Owner’s building personnel will be present at all times during the performance of the Work by the Contractor should Work be necessary during non-normal hours, weekend, School District employee Holidays and after the date of substantial completion. If the Contractor needs access to the sites other than normal campus working hours, notification shall be provided to the Owner’s Representative through the Facilities Planning and Construction Office Project Manager. The attached “Contractor Overtime Building Access Request Form” within this section shall be submitted for all overtime requests to obtain Owner approval.
- B. Overtime requests/scheduling: Contractor shall request with the attached form and submit by noon, a minimum of three (3) days in advance of the anticipated Work an overtime request. These requests shall be a minimum of four (4) hour charge. If Contractor does not work the entire time of requested overtime hours, the Contractor will still be responsible for paying the total requested overtime hours billing. With each request, Contractor will be billed 30 minutes to allow Operations to open and secure the building as well as 30 minutes for lunch.
- C. The Contractor shall compensate the Owner at the rate of twenty-two (\$22.00) dollars per hour for non-normal and weekend hours, and thirty-three (\$33.00) dollars per hour for School District employee Holidays.
- D. Overtime cancellations: Contractor shall request and submit by noon, a minimum of two (2) days in advance of the anticipated Work an overtime cancellation request should scheduled work and overtime not occur. If Contractor fails to cancel, they will be charged the four (4) hour minimum charge.
- E. Invoices will be submitted by the Owner to the Contractor on a monthly basis and are payable upon receipt to Cypress-Fairbanks I.S.D. Operations Department. Payment must be received within thirty (30) days of the invoice date. Owner reserves the right to refuse future overtime requests as well as the rejection of any current application for payment until such time outstanding payments are received.
- F. Hours:
 - 1. Normal School hours: 6:30 AM – 11:30 PM Monday – Friday
 - 2. Summer hours: 6:00 AM – 4:30 PM Monday - Thursday
 - 3. Not including District recognized employee Holidays per academic year calendars on District’s website: Spring Break Week, Thanksgiving Week and Winter Break
6:00 AM – 2:30 PM
 - 4. Food Production, school kitchens:

Elementary	7:00 AM – 3:30 PM for most, verify with Owner
Middle	6:30 AM – 3:00 PM for most, verify with Owner
High	6:00 AM – 2:30 PM for most, verify with Owner
- G. Package renovation and construction projects containing multiple district campuses will require overtime requests/cancellations be submitted for each building as needed.
- H. Overtime agreements made that differ from the above noted guidelines will not be accepted or honored.
- I. For site work only, the Contractor is required to complete the overtime form and submit it to the District. There will be no charge for site work only to the Contractor. The District will notify all parties to inform them work is being scheduled to be performed on our site.

Signature page continued below.

By signature of this document, I hereby state that I (or designated representative of this Company as indicated below) have reviewed the project sites, reviewed the Contract Documents and read the Specifications including the General Conditions as Amended, Supplementary Conditions and Special Owner Requirements in their entirety and do fully understand and agree to fully abide by all requirements established herein.

Respectively Submitted,

By: _____
Signature

Printed Name

Title

Company Name

Street Address

City, State, Zip Code

(Seal - if Proposer is a Corporation)

Date _____ State of _____ County of _____

Subscribed and sworn to before me this _____ day of _____

Notary Public:

My Commission expires:

NOTE: Form must be notarized and attached to the Construction Contract.

**CONTRACTOR
 OVERTIME / BUILDING ACCESS REQUEST FORM
 CYPRESS-FAIRBANKS INDEPENDENT SCHOOL DISTRICT**

<u>CONTRACTOR:</u>	<u>CYPRESS-FAIRBANKS ISD USE ONLY:</u>
1. Date of Request: _____	1. Total Overtime Hours Requested: _____
2. Project: _____	2. Total Overtime Amount Due Cy-Fair ISD: _____
3. CFISD Project Number: _____	3. Date Submitted to Operations: _____
4. Campus: _____	4. Date Submitted to Security: _____
5. Requested Date: _____	5. Date Submitted to Facilities Use: _____
6. Requested Hours: _____ (Minimum 4 hours must be requested)	6. Comments:
7. General Contractor/Subcontractors Working and contact mobile phone numbers: _____ _____	
8. Project Manager and Superintendent's Name and contact mobile phone numbers: _____ _____	
9. Requested By: _____	

On a monthly basis and prior to contract closeout and final payment by the Owner, the Contractor hereby agrees to reimburse Cypress-Fairbanks ISD the amount of twenty two (\$22.00) dollars per hour for non-normal days & weekend hours and thirty three (\$33.00) dollars per hour for School District employee Holidays for the above requested overtime hours. Reimbursement will be made by separate check made payable to the Cypress-Fairbanks ISD Operations Department within thirty (30) days of invoice date. If Contractor does not work the entire time of requested overtime hours, the Contractor will still be responsible for the total requested overtime hours. With each request, Contractor will be billed 30 minutes to allow Operations to open and secure the building and also includes 30 minutes for lunch.

Acknowledged and Agreed to by: _____
 Contractor's Signature Date

 Printed Name

Approved by: _____
 CFISD Project Manager's Signature Date

 Printed Name

END OF SECTION

Section 01 35 23.2

Special Owner Requirements - Badging Process

For Contractors, Sub-Contractors, Service Providers, & Vendors

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

Refer to enclosed instructions and Form AP packet for necessary submission information and procedures.

1.1 SECTION INCLUDES

- A. This Section has been added to identify and reinforce specific items that are currently defined in depth in the specifications, and that are of great importance to Cypress-Fairbanks Independent School District. The Owner of the Construction Company making an offer on the project must sign these documents and an original, notarized copy will be attached to the Construction Contract.
- B. Mandatory photo identification badge with the workers name and name of the Construction Company, which shall be worn at all times *[required after Substantial Completion for new buildings; required at all times for renovations]* shall be provided by the Owner and payable by the General Contractor. The General Contractor shall provide a list of all employees, suppliers, etc., that will be on the job site for more than 1 hour per day. The Owner reserves the right to reject issuing a security badge to any contractor employee as deemed appropriate to protect the Owner's interest. The Owner reserves the right to dismiss any worker not wearing proper identification, from the project site. Back charges are applicable for any infraction of this requirement.
- C. Lists must be forwarded to the Facilities Planning & Construction Department 72 hours or earlier in advance of going to the site.
- D. List shall be submitted on forms contained in Form AP packet.
- E. Should a Contractor want to add names to their original list, they must be added on a separate list.
- F. A maximum of 5 groups of **3-4 workers** may report to the Facilities Planning and Construction Department to have photos taken and pick-up the identification badges, based upon the agreed upon schedule. If more than the maximum number of workers show up, they will be asked to wait, or to return at a later time.
- G. Badges will include the General Contractor, Subcontractor or Sub-subcontractor name, expiration date of the project, and photo identification of the authorized person. The expiration date will typically be 6 months after the scheduled contract substantial completion date, but not longer than one year from date of issuance. Upon expiration, the contractor shall repeat the application process. There is no charge for renewal badges provided that the worker returns his previous badge. Otherwise, the \$10.00 charge applies.
- H. Badges must be worn at all times by all General Contractor, Subcontractor or Sub-subcontractor personnel on school district property during the construction of the project.
- I. The Contractor will be invoiced by Facilities Planning, & Construction and will be responsible for payment within 30 days of the invoice date.
- J. Should a person lose a badge and need a replacement, this procedure will be used to obtain the replacement badge. A \$10.00 charge for the replacement badge will be applicable for all lost badges.
- K. The Contractor shall contact Facilities Planning, & Construction with any questions during the process. The Contractor shall not contact Cypress-Fairbanks Police Department directly.

- L. Contractor shall return all project badges to CFISD. This included but is not limited to the Contractor, Sub-contractor, sub-sub-contractor, etc. Should badges not be returnable, Contractor shall submit letter in writing noting badges are lost for CFISD records as well as be assessed a fee of \$10.00 for each badge not returned to CFISD. If Contractor fails to pay such fees, the Owner will deduct such charges from the final payment.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

- 3.1 Refer to and follow the attached instructions.

END OF SECTION

SECTION 01 36 13

RENOVATION PROJECT PROCEDURES

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

- A. This Section contains general provisions and requirements pertaining to all remodeling, removal, and relocation of Work in the existing building and becomes a part of each Section and Division performing remodeling, removal and relocation Work for this Project with the same force and effect as if written in full therein.
- B. Take all necessary precautions to keep students and other trespassers out of the Work areas. Secure Work areas from entry when Work is not in progress.
- C. Perform all alterations, remodeling, demolition, removal and relocation of Work in strict accordance with Owner's instructions and applicable Federal, State and local health and safety standards, codes and ordinances. Where conflicts occur, the more restrictive requirement shall govern.
- D. Refer to section 01 71 50 Preventive Housekeeping and Final Carpet Cleaning.

1.2 RELATED WORK

- A. Section 02 41 01 - Demolition

1.3 EXISTING CONDITIONS

- A. Obvious existing conditions, installations and obstructions affecting the Work shall be taken into consideration as necessary Work to be done, the same as though they were completely shown or described.
- B. Items of existing construction indicated to remain upon completion of the Contract, but which require removal to complete the Work, shall be carefully removed and replaced as required. The replaced Work shall match its condition at the start of the Work unless otherwise required.
- C. Visit the site to determine by inspection all existing conditions, including access to the site, the nature of structures, objects and materials to be encountered, and all other facts concerning or affecting the Work. Information on the Drawings showing existing conditions does not constitute a guarantee that other items may not be found or encountered.
- D. Utilities: Do not interrupt existing utilities serving occupied or used facilities, except when authorized by the Architect/Owner in writing two (2) weeks in advance. Provide temporary services during interruptions to existing utilities.

PART 2 - PRODUCTS

2.1 SALVAGED MATERIALS

- A. The Owner reserves the right of first refusal on all salvage items. Remove remaining items from the site as Work progresses. Storage or sale of items on site is not permitted. Burning or burying of removed materials on site is not permitted.
- B. Store salvaged items in a dry, secure place on site.

- C. Salvaged items not required for use in repair of existing Work shall remain the property of the Owner.
- D. Do not incorporate salvaged or used material in new construction except where specified in the Contract Documents

2.2 PRODUCTS FOR PATCHING, EXTENDING AND MATCHING

- A. Contract Documents do not define products or standards of workmanship present in existing construction. Determine products by inspection and by use of the existing. Provide same or similar quality products or types of construction as that in existing structure when needed to patch or extend existing Work.
- B. If reasonably matching products are not obtainable, improve appearance by minor relocating of some existing products and grouping new ones in some pattern arranged by the Architect.

PART 3 - EXECUTION

3.1 PROTECTION OF WORK TO REMAIN

- A. Protect existing Work from damage. Use barricades, tarpaulins, temporary walls, plywood, planking, masking, or other suitable means and methods as approved by the Architect.
- B. If Work to remain in place is damaged, restore to original condition at no additional cost to the Owner.
- C. Concealed Conditions: If conditions cause changes in the Work from requirements of the Contract Documents, the Contract Sum will be adjusted in accordance with the General Conditions.

3.2 PROCEDURES

- A. Refinishing At Removed Work: Cut below surface of substrate materials and patch over area of removal with finish materials so removal is not apparent.
- B. Remove and replace existing ceilings, and cut, patch, or replace existing walls, partitions and floors as may be necessary for access to valves, piping, conduit and tubing by mechanical and electrical trades as directed and approved by the Architect, and performed by the appropriate subcontractor for the Work involved, or by other properly qualified subcontractors.
- C. Patch and extend existing Work using skilled mechanics who are capable of matching existing quality and workmanship. Quality of patched or extended Work shall be not less than that specified for new Work.
- D. Cutting:
 - 1. Concrete and Masonry: Saw cut where feasible.
 - 2. Plaster: Cut back to sound plaster on straight lines, and back-bevel edges of remaining plaster. Trim and prepare existing lath for tying of new lath.
 - 3. Woodwork: Cut back to a joint or panel line. Undamaged removed materials may be reused.
 - 4. Resilient Tiles: Remove in whole units to natural breaking points or straight joint lines with no damaged or defective existing tiles remaining where joining new construction.
 - 5. Salvaged Materials: Carefully remove to avoid damage, thoroughly clean and reinstall as indicated, or as directed.
 - 6. Doors: Remove in such a manner as to facilitate filling in of openings or installation of new Work, as required by Drawings. **Refer to Finish Hardware Section for specific**

- requirements for salvage of existing finish hardware.** Provide construction cores as required to maintain security and access control.
7. Structural Elements: Remove only as shown on the Structural Drawings. If not specifically shown, but removal is required, perform such removal or alteration only upon written approval of the Architect. Do not damage or alter any structural element of the existing building.
- E. Patching:
1. Match existing Work where possible; if unavailable, use salvage material for patching and provide totally new material in areas where salvage has been removed; consult with the Architect concerning locations for salvaging materials.
 2. Repairs or continuations of existing Work shall be relatively imperceptible in the finished Work when viewed under finished lighting conditions from a distance of six (6) feet.
 3. Patching, Repairing and Finishing of Existing Work: Perform in compliance with the applicable requirements of the Specification Section covering the Work to be performed and the requirement of this Section.
- F. Erect scaffolding as necessary to gain access to the various parts of the Work. Provide structurally sound, rigidly braced and properly constructed scaffolding, shoring, and bracing as necessary to positively protect the affected elements and building, and to support the activities or workmen and loads. Design and construction of scaffolds and supports shall be in accordance with applicable safety regulations. Material used shall be adequate to support anticipated loads with a properly calculated margin of safety.
- G. Noise Producing Equipment: Minimize use of noise producing equipment. Limit excessive noise to periods of vacancy or provide sound control. Arrange schedules in advance with the Architect and Owner.

3.3 EXISTING FURNITURE AND EQUIPMENT

- A. Owner Salvaged Items: Personal items in areas subject to remodeling will be removed by Owner before construction in those areas commences. Contractor shall notify Owner if any personal items remain; Owner shall remove such items.
- B. Furniture Items - Renovation: Contractor shall be responsible for any furniture relocation, storage, and move-back necessary to complete scope of work. Contractor to coordinate activities with Owner. Contractor is solely responsible for protecting furniture and equipment and is therefore solely responsible for any damage to said items and ensuing costs in restoring damaged items to same condition or replacing lost or damaged items beyond repair, unless specified as an allowance (Section 01 21 00).

3.4 PAINTING

- A. Preparation: Prepare patched areas as required for new Work. Wash existing painted surfaces with neutral soap or detergent, thoroughly rinse, and sand when dry.
- B. Painting and Finishing: Conform to the applicable provisions of the Painting Section. Prepare bare areas and patches in existing painted surfaces with specified primer and intermediate coats, sanded smooth and flush with adjoining surfaces.

3.5 DISPOSAL OF DEBRIS

- A. Remove daily material, debris and rubbish resulting from Work of this Section from the building and site as it accumulates. Keep all areas of Work in "broom clean" condition as the Work progresses.

3.6 JOB SUPERINTENDENT

- A. If renovation project includes Work at more than one site, Contractor shall have supervision at all sites as follows:

Cy Ranch HS shall have at least one full-time Superintendent.

Cy Ranch HS shall have at least one full-time Assistant Superintendent.

3.7 FINAL CLEANING

- A. At completion of renovation and remodeling Work in each area, provide final cleaning of all surfaces and return all areas affected by construction to a condition suitable for use by the Owner. Final cleaning shall include dusting of all surfaces; thorough cleaning of all surfaces including the removal of smudges, marks, stains, fingerprints, soil, dirt, paint spots, lint, discolorations, and other foreign materials; vacuuming of carpets; cleaning of all new carpeting by manufacturer-approved contractor; wet-mop cleaning of tile, and waxing of VCT, terrazzo surfaces per CFISD-approved methods. Refer to section 01 71 50 for Preventive Housekeeping and Final Carpet Cleaning.

END OF SECTION

SECTION 01 36 13.1

CUTTING AND PATCHING

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Execute cutting (including excavating and backfilling), fitting or patching of the work, required to:
 - 1. Make several parts fit properly.
 - 2. Uncover work to provide for installation of ill-timed work.
 - 3. Remove and replace defective work.
 - 4. Remove and replace work not conforming to requirements of the contract documents.
 - 5. Remove samples of installed work as specified for testing.
 - 6. Install specified work in existing construction.
- B. In addition to contract requirements, upon written instruction of the Architect:
 - 1. Uncover work to provide for observation of covered work.
 - 2. Remove samples of installed materials for testing.
 - 3. Remove work to provide for alteration of existing work.
- C. Do not endanger any work by cutting or altering the work or any part of it.
- D. Do not cut or alter the work of another Contractor without written consent of the Architect.
- E. Prior to cutting that affects structural safety of the project or the work of another Contractor, secure written approval of the Architect.

1.2 PAYMENT FOR COSTS

- A. Costs caused by ill-timed or defective work or work not conforming to the contract documents, including the cost of additional services of the Architect, Third-Party Consultants, and Owner, will be borne by the Contractor.
- B. Work done on written instructions of the Owner or Architect, other than defective or nonconforming work, will be paid by the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Materials required for replacement of the work removed must conform to the specifications for the type of work to be done.

PART 3 - EXECUTION

3.1 PREPARATION:

- A. Provide shoring, bracing and support as required to maintain the structural integrity of the project.
- B. Provide protection for other portions of the project.
- C. Provide protection from the elements.

3.2 PERFORMANCE

- A. Execute fitting and adjustment of products to provide finished installation to comply with specified tolerances and finishes.
- B. Execute cutting and demolition by methods which will prevent damage to other work and will provide proper surfaces to receive installation of repairs and new work.
- C. Execute excavation and backfilling by methods which will prevent damage to other work and will prevent settlement.
- D. Restore work which has been cut or removed; install new products to provide complete work in accordance with requirements of the contract documents.
- E. Refinish entire surfaces as necessary to provide an even finish. On continuous surfaces, refinish to the nearest intersections. For an assembly, refinish the entire item.

END OF SECTION

SECTION 01 45 00

QUALITY CONTROL

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Quality Assurance: Requirements for material and product quality and control of installation
- B. Tolerances
- C. References and Standards
- D. Mock-ups
- E. Testing Laboratory Services
- F. Inspection Services
- G. Manufacturers' field services

1.2 RELATED SECTIONS

- A. Section 01 41 00 - Regulatory Requirements
- B. Section 01 45 23 - Testing and Inspecting Services
- C. Section 01 33 00 - Submittal Procedures
- D. Section 02 32 00 - Geotechnical Report
- E. The work of this Section shall be included as a part of all Sections of work, whether referenced therein or not.

1.3 DESCRIPTION OF REQUIREMENTS

- A. Unless specifically noted otherwise, perform all work shown, mentioned, or reasonably inferred and comply with all work restrictions.
- B. Many of the requirements specified elsewhere are included herein for reference and convenience. Where a conflict occurs between the Contract Documents, either within themselves or each other, the more stringent requirement or the most expensive combination of materials and workmanship shall prevail.
- C. Contractor shall:
 - 1. Perform work in accordance with the General Conditions, as specified herein, and with the quality control requirements of each Specification Section.
 - 2. Perform work in the highest quality workmanship, unless specified otherwise.
 - 3. Join materials with a uniform and accurate fit so they meet with neat straight lines, free of smears, overlaps or irregularities, as applicable to the work.
 - 4. Install all exposed materials appropriately level, plumb, and at accurate angles as shown and flush with adjoining materials.

5. Attach materials with sufficient strength, and with number and spacing of fasteners and attachments that will not fail until materials joined are broken or permanently deformed.
6. Use concealed fasteners, unless shown or directed otherwise.

1.4 QUALITY ASSURANCE AND CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturer's instructions conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
- D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform work by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.5 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

1.6 REFERENCES AND STANDARDS

- A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by date of issue current on date of Owner-Contractor Agreement except where specific date is established by code.
- C. Obtain copies of standards where required by product specification sections.
- D. When specified reference standards conflict with contract documents, request clarification from Architect/Engineer before proceeding.
- E. Neither contractual relationships, duties, responsibilities of parties in contract nor those of Architect/Engineer shall be altered from contract documents by mention or inference otherwise in reference documents.
- F. Refer to Section 01 41 00, Codes, Regulations and Standards, for additional information concerning applicable reference and standards requirements.

1.7 MOCK-UP REQUIREMENTS

- A. Tests will be performed under provisions identified in this section and identified in respective product specification sections.
- B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- C. Accepted mock-ups shall be the comparison standard for remaining work.
- D. Where mock-up has been accepted by Architect/Engineer and is specified in product specification sections to be removed; remove mock-up and clear area when directed to do so by Architect.
- E. Mock-up may be approved in phases as portions are completed.
- F. Project Mock-up Requirements: Provide an actual sample mockup wall with multiple panels with the following properties:
 - 1. Size: Minimum 8 feet wide by 8 feet tall. Size may vary according to specific project requirements. Brace and support as required to withstand structural windloads.
 - 2. Materials: actual exterior finishes including, but not limited to face brick, cast stone, and plaster, actual building materials and assemblies indicating brick patterns on masonry and stud back-up as occurs with dampproofing and flashing as detailed, actual portion of aluminum storefront indicating jam, sill and head attachment and flashing details, and where appropriate, provide mock-up of special finish details, insets and reliefs, reveals, expansion and control joints, brick ledges, brick head and sills, pipe penetrations and waterproofing materials. Provide roof edge flashing and gutter section (as applicable) in pre-finished color as selected by Architect to cap the mock-up panel. Include a sealant joint at least 16 inches long. Brick and Mortar color shall be selected by Architect prior to mock-up assembly.
 - 3. Drawing: Refer to mock-up diagram on Drawings for minimum project requirements. Mock-up drawing is for reference only. Actual mock-up drawing will be submitted by the Architect after submittals have been approved.

1.8 TESTING SERVICES

- A. Owner will appoint, employ, and pay for specified services of an independent firm to perform testing.
- B. The independent firm will perform tests and other services specified in individual specification sections and as required by the Architect/Engineer, Owner, or authority having jurisdiction.
- C. Testing and source quality control may occur on or off the project site. Perform off-site testing as required by the Architect/Engineer or the Owner.
- D. Reports will be submitted by the independent firm to the Owner, Architect/Engineer, and Contractor, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
- E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
 - 1. Notify Architect/Engineer and independent firm 48 hours prior to expected time for operations requiring services, or as specified in individual specification sections.
 - 2. Make arrangements with independent firm and pay for additional samples and tests required.
- F. Testing does not relieve Contractor to perform work to contract requirements.

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- G. Re-testing required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by the Architect/Engineer. Payment for re-testing will be charged to the Contractor by deducting testing charges from the Contract Sum/Price.
- H. Refer to Section 01 45 29, Inspection and Testing Laboratory Services, for additional information concerning testing, and submittal procedures and requirements for Testing Reports.

1.9 INSPECTION SERVICES

- A. Owner will appoint, employ, and pay for specified services of an independent firm to perform inspection.
- B. The independent firm will perform inspections and other services specified in individual specification sections and as required by the Architect/Engineer, Owner, or authority having jurisdiction.
- C. Inspecting may occur on or off the project site. Perform off-site inspecting as required by the Architect/Engineer or the Owner.
- D. Reports will be submitted by the independent firm to the Owner, Architect/Engineer, and Contractor, indicating inspection observations and indicating compliance or non-compliance with Contract Documents.
- E. Cooperate with independent firm; furnish safe access and assistance by incidental labor as requested.
 - 1. Notify Architect/Engineer and independent firm 48 hours prior to expected time for operations requiring services, or as specified in individual specification sections.
- G. Inspecting does not relieve Contractor to perform work to contract requirements.
- H. Refer to Section 01 45 29, Inspection and Testing Laboratory Services, for additional information concerning inspections, and submittal procedures and requirements for Inspection Reports.

1.10 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as required, and to initiate instructions when necessary.
- B. Submit qualifications of observer to Architect/Engineer within ten (10) days after receipt of Notice to Proceed, in advance of required observations. Observer subject to approval of Architect/Engineer and Owner.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.
- D. Refer to Section 01 33 00, Submittal Procedures, for additional information concerning submittal procedures and requirements for Manufacturers Field Reports.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify existing site conditions and substrate surfaces are acceptable for subsequent work. Beginning new work means acceptance of existing conditions.
- B. Verify existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Verify utility services are available, of correct characteristics, and in correct locations.

3.2 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

END OF SECTION

SECTION 01 45 29

INSPECTION AND TESTING LABORATORY SERVICES

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 DESCRIPTION (refer to Document AB for substitutions).

- A. All third-party inspection and testing laboratory services will be provided and paid for by the Owner or by allowance in this contract. An inspection and testing lab will be selected by the Owner and the Contractor will be notified as soon as possible.
- B. The Owner will pay for the initial inspection and testing laboratory services of materials that comply with the requirements of the Contract Documents. The Contractor shall pay for re-inspection and re-testing of materials that do not comply with the requirements of the Contract Documents, and for re-inspection and re-testing due to “no-shows” and cancellations by Contractor or Subcontractors.
- C. The Contractor shall coordinate and cooperate with the inspection and testing laboratory in all matters pertaining to the work. The Owner retains the option to add to or delete any or all inspection and testing specified herein.
- D. The third-party inspection and testing laboratory services are for the Owner’s benefit. These services shall in no way relieve Contractor of Contractor’s responsibility to provide quality control of all materials incorporated into the Work.
- E. Contractor may be subject to reimbursing owner if the Contractor’s means and methods are shown to cause an overrun in the Owner’s contract with testing lab.
- F. Prior to or during the pre-construction meeting, Contractor shall coordinate with the District’s selected testing lab in order to ensure proposal costs are not exceeded and schedule is congruent to testing proposed. Failure to coordinate may result in backcharges if overages are realized.
- G. Contractor shall submit a construction schedule at time of bid for the testing lab’s use.
- H. Contractor shall allow for in their proposal the coordination and supervision of tests to be performed by an independent laboratory as selected by the Owner.

1.2 RELATED REQUIREMENTS

- A. Conditions of the Contract: Inspections and testing required by laws, ordinances, rules, regulations, orders or approvals or public authorities.
- B. Respective Sections of Specifications. Certification of products.
- C. Each Specification Section Listed: Inspection and laboratory test required and standards for inspection and testing.
- D. Testing laboratory inspection, sampling and testing are required for, but not limited to the following:
 - 1. Division 31 - Earthwork
 - 2. Section 03 30 00 - Cast-In-Place Concrete
 - 3. Section 05 31 23– Steel Roof Decking
 - 4. Section 04 20 00 - Unit Masonry
 - 5. Section 05 12 00 - Structural Steel
 - 6. Section 07 52 19 - Modified Bituminous Membrane Roofing System

7. Division 23 - Mechanical (Inspection and testing of welds and bolts on mechanical piping)
As requested by the Owner, Architect, or Engineer.

1.3 AUTHORITIES AND DUTIES OF THE LABORATORY

- A. The inspection and testing laboratory is not authorized to revoke, alter, relax, enlarge, or release any requirement of the Specifications, or to approve or accept any portion of the Work. When it appears that the material furnished or work performed by the Contractor fails to fulfill specification requirements, the inspection and testing laboratory shall promptly notify the Owner, General Contractor, Architect, Engineers, supplier and/or subcontractor providing or preparing the materials or work being tested of such deficiencies.
- B. The inspection and testing laboratory shall promptly distribute copies of the laboratory test and inspection reports. Standard distribution shall include copies of all reports to the Owner, Architect, and General Contractor. The Structural Engineer, Civil Engineer, MEP Engineer, concrete supplier, and any outside consultants shall receive copies of the testing results regarding their particular phase of the Project. Consult with Owner to determine Owner's preference of distribution (hard copy, electronic, etc.).
- C. The testing laboratory shall provide testing services under a separate agreement with the Owner or Architect, who shall be responsible for the costs of initial testing – pass or fail.
 1. The Contractor shall be responsible for costs of all re-tests required to achieve passing results.
 2. The Contractor shall be responsible for charges of the testing lab for expenses incurred for cancelled and/or mis-scheduled testing requests.
 3. The testing lab shall invoice Contractor direct for all re-tests of failed initial tests; and send copies of the invoices to the Architect and Owner for record.
 4. The testing lab and Contractor shall be responsible to negotiate and execute a separate agreement if required by the testing lab for charges described above.
- D. The testing lab is required to furnish a report of the status of testing performed as it relates to anticipated expenses described in the Agreement with the testing lab. Reports shall be furnished at most bi-monthly to the Owner and Architect.
 1. Report information shall include verification that Owner paid testing progress corresponds with anticipated expenses.
 2. The testing lab shall be required to notify the Architect and Owner immediately in writing if/when the testing lab anticipates exceeding the line item and or lump sum fee agreed by Owner.
 3. Such notification must occur prior to expensing 75% of the testing lab fee.

1.4 TESTING LABORATORY GUIDELINES AND PROCEDURES

- A. Technicians scheduled to perform specific inspection and testing services must be qualified to review and perform other services that overlap, i.e., earthwork, foundation inspections, rebar inspection, and concrete when scheduled concurrently at the Project site.
- B. Concrete design mixes will receive a cursory review with any discrepancies reported to the Architect/Engineer. No compensation will be considered for these reviews.
- C. Nuclear density testing will be based on a daily rental rate for the actual testing equipment, compensation on a per test basis will not be considered.
- D. Report distribution shall include the Owner, Architect, Contractor, Civil Engineer, Structural Engineer, and others requesting or requiring review of the specific testing results.

- E. Cylinders will be pick-up by the technician performing test the next day in order to have them cure under laboratory conditions.
- F. Structural steel inspections shall include a plant visit reviewing shop fabrication, welding, and an overall review of the shop fabrication quality control standards.
- G. The Contractor shall bear the responsibility of scheduling all the inspection and testing services. The Contractor and the testing laboratory shall assume full responsibility to coordinate the inspection and testing services. Cancellations and or failed test will be reimbursable to the Owner by the Contractor. Contractor will provide and maintain a sign-in sheet for testing lab services.
- H. Technician time for services performed will be reimbursed at a regular time rate. Compensation at the overtime rate will be considered for any hours over eight hours spent at the job site on a single day, field testing services performed on a Saturday or Sunday, and any field services performed on a recognized holiday.

PART 2 - PRODUCTS

Not Used

PART 3 – EXECUTION

3.1 GENERAL

- A. Inspection and testing services shall include, but not be limited to those specified below or which are necessary or required during course of construction to ascertain specification compliance and which may be deemed necessary by Architect, Engineer, or Owner to ensure the quality of the Work.
- B. Where requirements of this Section are in conflict with requirements noted on the Contract Drawings or other Sections of the Specifications, the more stringent requirement shall apply, unless directed otherwise by Architect.
- C. Should any unusual conditions be encountered during any operations, the laboratory shall be contacted immediately so that additional inspection and testing, as applicable, can be provided.
- D. The Owner reserves the right to add to or delete any or all inspection and testing specified herein.

3.2 SITE GRADING

- A. Testing Services:
 - 1. Perform field tests for moisture density properties.
 - a. In each compacted fill layer, provide one (1) field test for every 5,000 square feet of area, but not less than three (3) tests.
 - b. At paved area, provide one (1) field test for every 5,000 square feet, but not less than three (3) tests.

3.3 COMPACTING FILL AND BACKFILL

- A. Testing Services:
 - 1. Perform field test for moisture density properties:
 - a. Within the building line provide one (1) field test in each compacted layer for every 5,000 square feet of area, but not less than three (3) tests.

3.4 PAVING

- A. Testing Services:
 - 1. Perform field tests for moisture density properties:
 - a. Provide field testing of the sub-grade as described in Paragraph 3.2, A, 2 above.
 - b. Paving sub-base, provide one (1) field test for every 5,000 square feet of area of crushed limestone or caliche sub-base, if any.
 - c. Lime treated sub-grade, provide one (1) field test for every 5,000 square feet of area of lime treated sub-grade, if any, for content of lime and sub-grade compaction.
 - d. Cement soil stabilization, if any, provide one (1) field test for every 5,000 square feet of area of cement stabilized sub-grade for content of cement and sub-grade compaction.

3.5 PIPED SITE UTILITIES

- A. Inspection and Observation Services:
 - 1. Inspection of trenches for proper alignment and grade.
 - 2. Inspection of pipe bedding and supports.
 - 3. Inspection of pipe, joints, jointing material, and thrust blocks prior to installation of pipe.
 - 4. Inspection of installation of pipe and joints.
 - 5. Observation of testing of piped utilities performed by Contractor.

3.6 EARTHWORK

- A. Inspection and Observation Services:
 - 1. Refer to and include, as applicable, work of Paragraphs 3.2, 3.3, 3.4, and 3.5 above.
 - 2. When perimeter and underfloor drainage systems are specified or required, inspect installation of such systems for conformance with specified materials and detail requirements.
 - 3. When temporary drainage and dewatering systems are used to keep excavations dry, inspect the systems for adequacy. Ground water should be maintained at least two (2) feet below bottom of excavation.
 - 4. Review the equipment and methods used in placement and compaction of fill materials and inspect materials used and compaction of fills in general earthwork and in backfilling around structures, and in backfilling in utility trenches.
 - 5. Notify the Contractor in writing and the Architect/Owner immediately if footings and slabs-on-grade are placed on unfinished soil or frozen ground and when footings and slabs-on-grade are not protected from frost damage.
 - 6. Notify the Architect/Owner when soil with allowable bearing capacity noted is encountered at elevation above the bottom of footing shown.
 - 7. Notify the Architect/Owner and Contractor if soil with required bearing capacity noted is not encountered at bottom of footing elevation shown. Bottom of footing shall be adjusted as recommended and approved by the Structural Engineer and Architect.
 - 8. Review rock excavation techniques, if required, and monitor blasting induced ground motions, as appropriate.
 - 9. Review calculations and shop drawings for sheeting, shoring, and underpinning prepared by the Contractor, if required.
- B. Testing Services:
 - 1. References (As applicable for tests):
 - a. ASTM International (ASTM)
 - 1) D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft³ (600 kN-m/m³))
 - 2) D2922, Standard Test Method for Density of Soil and Soil-Aggregate In Place By Nuclear Methods (Shallow Depth)
 - 3) D4318, Liquid Limit, Plastic Limit, and Plasticity Index of Soils

- b. American Association of State Highway and Transportation Officials (AASHTO)
 - 1) T89, Determining the Liquid Limit of Soils
 - 2) T90, Determining the Plastic Limit and Plasticity Index of Soils
 - 3) T99, Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb.) Rammer and a 305-mm (12-in) Drop
 - 4) T238, Density of Soil and Soil Aggregates In Place By Nuclear Methods (Shallow Depth)
 2. Perform sieve analysis to develop grain size distribution curves for materials to be used for subgrade, fill under slab-on-grade, and backfills.
 3. Establish the moisture density relation of soils to be used as fill using the method best suited to the type of fill material.
 4. Determine moisture content of all fill materials before placement and advise Contractor when it is or is not suitable to achieve required compaction.
 5. Determine Liquid Limit in accordance with ASTM D4318 or AASHTO T89, Plastic Limit in accordance with ASTM D4318, and Plasticity Index in accordance with ASTM D4318 of all fill material.
 6. Perform one (1) in place density test for each 2,500 square feet (280 square yards) of existing subgrade material.
 7. Perform Moisture-Density curve in accordance with ASTM D698 or AASHTO T99 for one (1) type of fill material. If the original choice of material does not meet the specifications, the Contractor shall pay for additional testing.
 8. Perform in place density tests of each lift of compacted fill at locations adequate to evaluate the degree of compaction of all fill areas. Conduct one (1) test for each 2,500 square feet (280 square yards) of each lift of compacted fill.
- C. Reports: Submit reports to Architect/Owner with the following information:
1. Type and condition of soil at footing bottoms.
 2. Level of water table in the excavated areas.
 3. Grain size distribution of fill materials (average of three (3) tests).
 4. Moisture density test results.
 5. In place density test results with moisture content and relative density of each layer of compacted fill. Include with in place density test results, a plan showing location of each test.
 6. Notify Architect/Owner by telephone within one (1) hour of the discovery of the following conditions and follow up telephone notification with written report.
 - a. Materials used, or degree of soil compaction not meeting specified requirements.
 - b. Frost and freeze protection requirements for excavation bottoms not being complied with.
 - c. Water in excavations which is not being removed prior to work being performed in excavation.

3.7 DRILLED AND UNDERREAMED (BELLED) PIERS

- A. Inspection and Observation Services:
1. Provide full time services for the review of all drilled pier foundation inspections. Including a daily report noting grid lines and locations of each pier drilled. After the foundation shaft has been drilled, the lab shall test an undisturbed sample and verify that it meets or exceeds the design specification.
 2. The drilling and verification of suitable soil for bearing capacity. Notify the Architect when soil with allowable bearing capacity noted is encountered at elevation above the bottom of pier shown. Notify the Architect and Contractor if soil with required bearing capacity noted is not encountered at bottom of pier elevation shown. Bottom of pier shall be adjusted as recommended and approved by the Structural Engineer and Architect.
 - a. Drilled shaft has been drilled plumb and within specified vertical and horizontal tolerances specified by the Structural Engineer.

- b. Drilled shaft and underreamed bells are excavated to specified depths and/or if conditions differ from those presented, to notify the Structural Engineer.
- c. Drilled shaft and underreamed bell bottoms are kept dry at all times, cleaned of excess cuttings, or all obstructions prior to placing reinforcing steel and concrete. If groundwater seepage occurs, it shall be removed prior to concrete placement or controlled with temporary steel casing to maintain the shaft integrity up to the concrete placement.
- d. Concrete reinforcing steel shall be checked for type, size, adequate placement and lap lengths, and doweled bars.

3.8 CONCRETE REINFORCING STEEL AND EMBEDDED METAL ASSEMBLIES

A. Inspection and Observation Services:

- 1. Inspect all concrete reinforcing steel prior to placing of concrete for compliance with Contract Documents and approved shop drawings. All instances of noncompliance with Contract Documents and approved shop drawings shall be immediately brought to the attention of the Contractor for correction and then, if uncorrected, reported to the Architect/Owner.

B. Reports:

- 1. Observe and Report on the Following:
 - a. Number and size of bars.
 - b. Bending and lengths of bars.
 - c. Splicing.
 - d. Clearance to forms including chair heights.
 - e. Clearance between bars or spacing.
 - f. Rust, form oil, and other contamination.
 - g. Grade of steel.
 - h. Securing, tying, and chairing of bars.
 - i. Excessive congestion of reinforcing steel.
 - j. Installation of anchor bolts and placement of concrete around such bolts.
 - k. Fabrication of embedded metal assemblies, including visual inspection of all welds.
 - l. Visually inspect studs and deformed bar anchors on embedded assemblies for compliance with Contract Documents. Check number, spacing and weld quality. If, after welding, visual inspection reveals that a sound weld or a full 360-degree fillet has not been obtained for a particular stud or bar, such stud or bar shall be struck with a hammer and bent 15 degrees off perpendicular and then bent back into position. Anchors failing this test shall be replaced.

C. Testing Services:

- 1. Will be required of all suspect materials or workmanship at the discretion of the Architect, Engineer, or Owner.

3.9 REINFORCING STEEL MECHANICAL SPLICES

A. Inspection and Observation Services:

- 1. Visually inspect and report on the completed condition of each mechanical splice of reinforcing steel.
- 2. Each mechanical splice shall be visually inspected to ensure compliance with the I.C.B.O. reports and the manufacturer's published criteria for acceptable completed splices.
- 3. Special emphasis shall be placed on inspection of the end preparation of each bar to be spliced, as required by the I.C.B.O. Report.

- B. Reports: Submit reports to Architect with the following information:
1. Submit copies of manufacturer's published criteria for acceptable completed splices prior to observing mechanical splices.
 2. Reports on each mechanical splice shall indicate location of the splice, size of bars spliced, and acceptability or rejection of splice. Reasons for rejection shall be shown on each report.

3.10 CAST-IN-PLACE CONCRETE

- A. Inspection and Observation Services:
1. Review concrete design mixes proposed for use on the Project.
 2. Provide full time services for all structural building concrete in drilled piers, grade beams, slab on grade, columns, concrete paving, and other miscellaneous structural concrete. Refer to and include work for reinforcement steel specified in Paragraphs 3.8 and 3.9 above.
 3. On the first day's batching of each type and each strength of concrete, inspect and observe materials for concrete, batch weights, moisture content, and gradation of fine and coarse aggregate.
 4. Provide additional inspection if the Contractor elects to use concrete from more than one (1) source of supply simultaneously. All costs for such additional inspection shall be borne by the Contractor.
- B. Testing Services:
1. References (As applicable for field and laboratory tests):
 - a. American Concrete Institute (ACI)
 - 1) 214, Recommended Practice for Evaluation of Strength Test Results of Concrete
 - 2) 318, Building Code Requirements for Reinforced Concrete
 - b. ASTM International (ASTM)
 - 1) C31, Practice for Making and Curing Concrete Test Specimens in the Field
 - 2) C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
 - 3) C138, Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
 - 4) C143, Slump of Hydraulic Cement Concrete
 - 5) C173, Air Content of Freshly Mixed Concrete by the Volumetric Method
 2. Compression Test Cylinders:
 - a. Make, transport, cure and test six (6) inch or (4) inch diameter by 12-inch-long test specimens taken from concrete being cast. Test cylinders will be made, handled, cured, and stored in accordance with ASTM C31, at the rate of four (4) cylinders minimum for each 50 cubic yards slab on grade or elevated slab four (4) cylinders minimum for each 100 cubic yards paving or fraction thereof of each class of concrete placed in any one (1) day.
 - b. Handle newly made cylinders carefully to avoid cracking the green concrete. Store these cylinders in a box at temperatures between 60 degrees F and 80 degrees F during first 24 hours. Contractor shall construct a suitable box and provide heat or cooling, if necessary, to maintain cylinders at proper temperature.
 - c. Place cylinders in laboratory storage, with molds removed, under moist curing conditions and temperature of 73 degrees plus or minus three (3) degrees F 24 hours after casting maintain these moist curing conditions until specimens are tested.
 - d. Of the test cylinders taken per 50 cubic yards or fraction thereof, test one (1) at seven (7) days and two (2) at 28 days after casting date. Store one (1) cylinder for testing at 56 days in the event the 28 days strength tests do not meet strength requirements. Test cylinders in accordance with ASTM C39. When Type III cement is used, test at three (3) days instead of seven (7) days.

- e. Each 28-day compression test report shall clearly indicate average strength results, concrete slump and air content, concrete and ambient air temperatures, and how much water was added on site by contractors as of the report date and for the class of concrete being reported.
 - f. Maintain a moving average for compressive strength based on the three (3) latest 28-day test results to check compliance with specification requirements. The figures for the standard deviation and moving average for strength will be kept continuously up to date and submitted on a weekly basis to the Architect and Engineer. Maintain a continuously up to date log in both graphical and tabulated form for each class of concrete.
 - 1) the average of the latest three (3) test results;
 - 2) the lowest average of three (3) consecutive test results recorded to date;
 - 3) the average of all sets of three (3) consecutive test results;
 - 4) the percentage of tests falling below specified strength;
 - 5) the lowest single test result.
 - g. Maintain a moving average for range of test results for quality control purposes as described in ACI 214, Chapter 4, Paragraphs 4.4 and 4.5. Graphical reports of moving average for range shall be submitted to the Architect and Engineer on a weekly basis.
 - h. Slump Tests: Conduct in accordance with ASTM C143; one (1) test shall be performed for each sampling for strength tests. Slump shall be considered acceptable if the field test is within the range of design slump plus or minus one (1) inch. For concrete placed by pumping, one (1) test shall be performed at the pump and one (1) at the point of deposit. Slump loss through pumping will be acceptable to the Architect and Engineer. Slump measured at the pump shall be evaluated for acceptance relative to the design slump in accordance with the criteria previously specified.
 - i. Air Content Tests: Conduct in accordance with ASTM C173; test air entrained concrete only, one (1) test shall be performed for each sampling for strength tests. Air content shall be considered acceptable if the field test is in the range of the design air content plus two (2) percent.
 - j. Unit Weight Tests: Conduct in accordance with ASTM C138; test each sample of lightweight concrete taken for strength tests. Unit weight shall be considered acceptable if the field test shows a fresh unit weight equal to the design unit weight plus or minus 2 pcf.
 - k. Chloride Tests: Perform one (1) total chloride ion test for each class of concrete placed each day. If the total chloride ion content is determined to be excessive by the Architect or Engineer, water soluble chloride ion tests shall be performed at the Contractor's expense.
3. Noncompliance: In the event the initial tests above indicate that concrete may not meet the specified requirements, the Architect or Engineer may, at his discretion, order additional tests be performed at the Contractor's expense. Load tests shall comply with requirements of ACI 318.

3.11 MASONRY

- A. Inspection and Observation Services:
 - 1. Inspection of placement of reinforcement including condition, grade, size, location, spacing, and lap splices.
 - 2. Review mortar design mixes.
 - 3. Inspection of laying, mortaring, and grouting of concrete masonry units and elements.
- B. Testing Services:
 - 1. References (As applicable for tests required):
 - a. ASTM International (ASTM)

- 1) C140, Standard Test Methods of Sampling and Testing Concrete Masonry Units
 - 2) C780, Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
 - 3) C1019, Standard Test Method for Sampling and Testing Grout
 - 4) E447, Standard Test Methods for Compressive Strength of Laboratory Constructed Masonry Prisms
2. Testing of Concrete Masonry Units (CMU):
- a. Preconstruction: Perform the following tests in accordance with ASTM C140.
 - 1) Compressive Strength
 - 2) Absorption
 - 3) Weight
 - 4) Moisture Content
 - 5) Dimensions
3. Mortar Tests:
- a. Preconstruction: Perform the following tests in accordance with ASTM C780 on each type of mortar mix used on the Project.
 - 1) 28 Day Compressive Strength
 - 2) Water Retention
 - b. Construction: Perform 28-day compressive strength test in accordance with ASTM C780 on each type of mortar mix used on the Project at the rate of one (1) test per 2,000 square feet of masonry.
4. Refer to and include work for reinforcing steel specified in Paragraphs 3.5 and 3.6 above.
5. Grout Tests:
- a. Preconstruction: Perform the following tests in accordance with ASTM C1019 on each type of grout mix used on the Project.
 - 1) Slump Test
 - 2) 28 Day Compressive Strength
 - 3) Construction: Perform 28-day compressive strength test in accordance with ASTM C1019 on each type of grout mix used on the Project at the rate of one (1) test per 2,000 square feet of masonry.
 - 4) Prism Test: Perform preconstruction 28-day compressive strength test on concrete masonry walls in accordance with ASTM E447, Method B.

3.12 STRUCTURAL STEEL

- A. Inspection Services:
1. General:
 - a. Review submittals from fabricator.
 - b. Review all shop and field welder's qualifications.
 2. Structural Steel, Steel Joists and Mechanical Piping:
 - a. Shop inspect each member for defects such as cracks, excessive camber, deformation, and specified surface preparation prior to shop priming or galvanizing.
 - b. Inspect shop priming for coverage and measure of mil thickness.
 - c. Perform visual inspection of all welds; measure 15 percent of welds.
 - d. Inspect size and placement of anchor bolts in concrete and masonry.
 - e. Verify that erector surveys plumbness of each column.
 - f. Verify that erector inspects alignment of beams, shelf angles, lintels, joists, joist girders, and other similar supporting members.
 - g. Perform visual inspection of bolts to determine that the method(s) used are in conformance with the Contract Documents.
 3. Metal Decks:
 - a. Field inspect material for type, gauge, finish and other requirements of the Contract Documents.
 - b. Field inspect installation methods including welding, alignment, joints, laps, and flatness, and all other requirements of the Contract Documents.

4. Steel Stud Shear Connectors:
 - a. Field inspect installation methods and welds.
 - b. Verify number of studs, stud placement and length for conformance with the Contract Documents.

- B. Testing Services:
 1. References (As applicable for tests required):
 - a. American Institute of Steel Construction (AISC)
 - 1) Specifications for Structural Joints Using ASTM A325 or A490 Bolts
 - b. ASTM International (ASTM)
 - 1) A6, General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use
 - 2) A325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
 - 3) A490, Standard Specification for Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
 - b. American Welding Society (AWS)
 - 1) D1.1, Structural Welding Code, Steel
 2. Structural Steel:
 - a. Perform all tests required by Structural Welding Code and authorities having jurisdiction.
 - b. Ultrasonically test all edges of material greater than 1-1/2 inch thick that is to be welded for evidence of laminations, inclusions, or other discontinuities. The extent to which such defects will be permitted, and the extent of repair permitted shall be in accordance with ASTM A6.
 - c. The root layer of all multiple pass welds and the backside of groove welds made from both sides, after back gouging or chipping, shall be tested by magnetic particle or dye penetration if magnetic particle is not feasible.
 - d. Fillet welds for beam and girder shear connections (15 percent at random) shall be tested by magnetic particle for final pass only.
 - e. Fillet welds for plate girder flange/web connections shall be tested by magnetic particle for final pass only.
 - f. Ultrasonically test 100 percent of full penetration welds.
 - g. Ultrasonically test 100 percent of partial penetration column splice welds.
 - h. Test 100 percent of continuity plate fillet welds by magnetic particle for final pass.
 - i. Perform all equipment calibrations and production tests of high strength bolt connections as required by AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts.
 - j. Randomly sample bolts, nuts, and washers from the Project Site at a rate sufficiently to test and verify compliance with ASTM Standards.
 - k. When bolts are tightened by “turn-of-the-nut” method, check by calibrated torque wrench 25 percent of bolts in each shear connection, but not less than two (2) bolts per connection.
 - l. In addition, provide at least one (1) test per 50 linear inches of weld by each welder, except that 100 percent of full penetration welds shall be tested using approved radiographic, magnetic particle, or ultrasonic method. Tolerance for welds shall be in accordance with the requirements of AWS D1.1 and the Contract Drawings.
 - m. Perform tension tests on steel in accordance with ASTM A6, if required.
 - n. Perform load tests on structural members in place, if required.
 3. Steel Stud Testing:
 - a. Test not less than ten (10) percent of studs on any beam, plus all studs indicating imperfections. Studs will be considered imperfect if, after welding, visual inspection reveals:
 - 1) Studs lacking full 360-degree weld.
 - 2) Studs which have been repaired by welding.

- b. Studs shall be tested by striking with a hammer and bending to approximately 15 degrees off vertical. Bend studs lacking full 360 degrees weld in a direction opposite to the side lacking the weld. Replace studs that crack after this test either in the weld or the shank. Studs meeting this test will be considered acceptable and left in place.

3.13 SPRAYED-ON FIREPROOFING

- A. Inspection Services:
 1. Inspection of sprayed-on fireproofing to ascertain compliance with Contract Documents.
- B. Testing Services:
 1. References (As applicable for tests required):
 - a. ASTM International (ASTM)
 - 1) E605, Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members
 - 2) E736, Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
 2. Perform tests on sprayed-on fireproofing for thickness and density in accordance with ASTM E605.
 3. Perform tests on sprayed-on fireproofing for cohesion and adhesion in accordance with ASTM E736.

3.14 LIGHTWEIGHT INSULATING CONCRETE FILL

- A. Inspection and Observation Services:
 1. Inspection of roof deck prior to start of work.
 2. Inspection during installation of insulation and lightweight insulating concrete fill work to ascertain compliance with Contract Documents.
 3. Observation of base ply fastener pull tests performed by Testing Lab to ascertain minimum withdrawal resistance of 40 pounds per square foot per fastener, based on ANSI/SPRI Protocol. Architect and Roofing Inspector to witness fastener pull tests.
- B. Testing Services:
 1. References (As applicable for tests required):
 - a. ASTM International (ASTM)
 - 1) C177, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties By Means of the Guarded-Hot-Plate Apparatus
 - 2) C495, Test Method for Compressive Strength of Lightweight Insulating Concrete
 - 3) C578, Specification for Rigid, Cellular Polystyrene Thermal Insulation
 2. Test EPS insulation board for thermal insulation value in accordance with ASTM C177.
 3. Test lightweight insulating concrete fill in accordance with ASTM C495 for:
 - a. Mix design compressive strength.
 - b. Mix design wet and dry density range.
 - c. Number of Tests:
 - 1) One (1) per 5,000 square feet
 - 2) Not less than one (1) for each day's work
 4. Test EPS insulation board for density in accordance with ASTM C578.

3.15 ROOFING SYSTEM

- A. Inspection and Observation Services:
 1. Attend pre-construction meeting prior to Contractor starting work.

2. Attend pre-installation meetings for decking, lightweight concrete, roofing, and sheet metal installations.
3. Review field mockups of sheet metal and other components as applicable.
4. Inspect on-site condition of stored roofing materials
5. Provide full-time roofing inspector during the following stages of construction:
 - Final stages of metal deck attachment
 - Lightweight concrete roof deck application
 - Modified bitumen roofing and metal roofing application
6. Provide spot inspections for sheet metal work and thru-wall flashing. Thru-wall flashing shall be left open by the Contractor until inspected, and sheet metal shall not be covered until inspected.
7. Witness water tests and pull tests completed by others.
8. Observe roof test cuts, and patching of cuts, performed by Contractor to ascertain that they are properly made.
9. Perform dissection and analysis on cuts provided by Contractor to confirm number of plies, bonding of plies, weight of bitumen and softening temperature to ascertain compliance with specifications.
10. Provide a written daily report in standardized format to Owner within 72 hours of inspection. The report shall describe all roofing-related activities as well as recommendations made to Contractor by the Inspector. The report shall also include a running list of items from previous reports that have not yet been addressed by Contractor. The reports shall also include an itemization of items that should be backcharged to the Contractor. Submit report to Contractor, Architect, and Owner.
11. Provide and maintain a sign-in sheet in the construction trailer. **Inspector shall sign in and out for every inspection, or Owner will not pay for that inspection.**
12. Attend the punch list walk and provide a written punch list of all roofing components to Architect and Owner.
13. Conduct a final inspection of all roofing components and provide Owner with a letter confirming that all punch list items are complete.
14. Review Siplast Warranty and provide a letter to the Owner confirming that it is correct and complete.

3.16 GLAZED SYSTEMS, TRANSLUCENT WALL PANEL SYSTEMS AND SKYLIGHTS

- A. Testing Services:
 1. Perform air and water infiltration testing on initial installation of each exterior glazed system, translucent wall panel system and skylight to ascertain compliance with specifications.

PART 4 – GENERAL – PROJECT CONSULTANT OBSERVATIONS

4.1 DESCRIPTION

- A. The Contractor shall include in his Proposal the coordination and scheduling of Observations to be performed by the Owner and Architect's project consultants, as they may apply to this work.
- B. All project consultant observation services shall be performed by designees of the relative consultant; upon which the Contractor may rely as to the capability and thoroughness of the observation being performed. Upon request by the Contractor, the names of inspectors performing specific observations shall be furnished by the Architect.
- C. The Owner shall pay for the observation services of the project consultants in accordance with the Owner / Architect Agreement and the requirements of the Contract Documents. Excessive observations and re-observations resulting from the Contractor's actions as described in paragraph 4.4 below, shall be paid for by the Contractor directly to the affected Consultant.

- D. The Contractor shall cooperate with the Owner's project consultants in all matters pertaining to required observations of the work as described in the Contract Documents. The Owner retains the option to add to or delete any or all observations specified herein; and thereby accept the relative work without observation.

4.2 RELATED REQUIREMENTS

- A. Conditions of the Contract, AIA Document A201 as amended, and Supplementary Conditions to the General Conditions for the Construction Contract, Specification section CA.
- B. Respective Sections of Specifications describing the required consultant observations.

4.3 AUTHORITIES AND DUTIES OF THE PROJECT CONSULTANT INSPECTORS

- A. The project consultant inspectors are not authorized to revoke, alter, relax, increase, or release the Contractor from any requirement of the Contract Documents without written notice furnished to the Contractor by the Architect. When it appears that the material, assembly or work performed by the Contractor fails to fulfill Contract requirements, the project consultant inspector shall promptly notify the General Contractor, Architect and Owner.
- B. The project consultant inspector(s) shall distribute copies of the observation reports within two (2) working days. Standard distribution shall include copies of all reports to the Owner, Architect, and General Contractor.

4.4 PROJECT CONSULTANT OBSERVATION GUIDELINES AND PROCEDURES

- A. Project Consultants shall make all observations required in the Contract Documents and requested by the Architect, Contractor and/or Owner.
- B. For each material, assembly or phase observation required in the Contract Documents, and upon request by the Contractor, the project consultant(s) shall perform the following observations as required in the Owner – Architect Agreement:
 - 1. Initial observation to determine compliance with the Contract Documents.
 - 2. Observation to determine deficiencies where the initial observation results do not show 100% compliance with the Contract Documents. At the consultant's discretion, this observation may be performed concurrent with the initial observation.

The above series of observations shall be at the expense of the Owner in accordance with the Owner/Architect Agreement. If re-observation is required to determine 100% compliance is required, it shall be at Contractor's expense.

- C. In the event the observation series described above does not result in 100% approval of the material, assembly or phase being inspected, all subsequent re-observations required to achieve 100% approval shall be at the sole expense of the Contractor to be paid to the project consultant (via Owner backcharge to the Contractor) based on the consultant's standard hourly rates for time expended, including travel to and from the site.
- D. Recognizing the size and complexity of work included in a project may be sufficiently large enough to require the project to be divided into scope areas, each such area shall be considered separate and stand-alone with respect to paragraph 4.4.B above. Requests by the Contractor for project consultant observations of partial scope areas shall be considered observations of the entire scope area with respect to paragraph 4.4.B above; and subsequent observations of the remaining portions of the same scope area shall be paid for by the Contractor (via Owner backcharge to the Contractor). Owner shall invoice the Contractor on a monthly basis, and payment shall be due upon the Contractor's receipt of the invoice.

- E. The Contractor shall bear the responsibility of requesting and scheduling all project consultant observations required by the Contract Documents. The Contractor shall give the project consultant a minimum of forty-eight (48) hours' notice prior to the requested observation. No extension of Contract Time shall be granted for untimely observations due to the Contractor's failure of proper observation request notification.
- F. Observations voluntarily made by project consultants at their discretion, not specifically requested by the Contractor, shall not count as one of the observations described in paragraph B above, nor shall the Contractor be liable for any related expenses.

4.5 PROJECT CONSULTANT OBSERVATIONS

- A. Earthwork
- B. Site Utilities prior to cover-up
- C. Concrete Reinforcing
- D. Cast-in-place concrete
- E. Structural steel
- F. All Building Envelope assemblies
- G. Mechanical rough-in prior to cover-up
- H. Plumbing rough-in prior to cover-up
- I. Electrical rough-in prior to cover-up
- J. Above ceiling prior to cover-up
- K. Start-up demonstrations of building systems and components
- L. Punch lists (treated separately for each architect and consultant). Refer to Specification Section CA, section 9.8
- M. Observation / review of O&M Manuals and other close-out documents
- N. Observation / review of Record Drawings

4.6 PROJECT CONSULTANT HOURLY RATES

- A. Refer to the A201 General Conditions of the Contract for Construction, as Amended Article 8 for applicable hourly rates.

PART 5 – GENERAL – GOVERNMENTAL INSPECTIONS

5.1 DESCRIPTION

- A. The Contractor shall include in his Proposal the application, coordination, scheduling and cost of all on-site inspections to be performed by governmental authorities having jurisdiction which are required for approval of the Work and occupancy of the building; including, but not limited to all City departments, all County departments, Flood Control Districts, Municipal Utility Districts, utility provider, Health Departments and Fire Marshal Offices.

- B. The Contractor shall make all corrective measures in accordance with instructions received from the governing authority inspector having jurisdiction, as required to receive 100% approval for the work being inspected.
- C. The Contractor shall bear all costs for initial inspections, re-inspections and any other expenses related to on-site inspections made by governing authority.
- D. No allowance shall be made for additional Contract Time, nor an increase in the Contract Sum for any unanticipated expenses or delays resulting from failed governmental inspection or resulting re-inspections required to obtain approval(s).

5.2 EXCLUSION

- A. The Contractor shall not be responsible for making application, coordination, inspections and receiving approval of the Work by the Texas Department of Licensing and Regulation relative to ADA and Texas Accessibility Standards.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Instructions to Proposers for substitutions.
- B. Temporary facilities shall only be for the duration of construction, unless noted otherwise, and all temporary facilities shall be completely removed at the completion of the project. Any areas disturbed by the placement of temporary facilities shall be repaired/replaced to a finished condition consistent with the surrounding finished area.

1.2 UTILITIES

- A. The Contractor shall supply temporary job power, drainage outfall, sanitary sewer, and water hook-ups for site. The Contractor shall provide all wiring, lamps, distribution of power and similar equipment as required for construction, inspection, and testing of each project.
- B. The Contractor is responsible for overloading or excess use, or any damage resulting from overloading or excess use, or any damage resulting from his use of utilities.
- C. The General Contractor shall provide temporary heat to prevent freezing and maintain proper temperatures to avoid damage to materials in the building and allow work to continue in such weather conditions. The General Contractor shall provide and maintain such dependable source of supply, such as heat, as may be necessary until the building is accepted.
- D. The Contractor will be required to provide temporary water and electrical connections for field sprinkler systems after Substantial Completion of the fields. These connections must be maintained through the duration of the Contract, or until permanent connections are made.
- E. Any utility usage at existing buildings in excess of 110% of historical usage for the previous 12-month period shall be paid by the Contractor.

1.3 FIELD OFFICE

- A. The Contractor will be required to furnish a job trailer installed at a suitable location (on site at one campus), for use by the Contractor, Architect, and Owner.
- B. Provide and maintain a weather-tight building with operable and lockable door and windows, to serve as a job office available to the Contractor, subcontractors, Owner, and the Architect. Provide lights, electricity, air conditioning and heat, as required. Remove office from premises when one can be set up inside the building. Provide job site telephone, internet, and other miscellaneous items as outlined below.
 - 1. Provide a separate lockable room (120 sq. ft.) in Contractor's job trailer to serve as an office for the Architect and Owner's representative or provide in a separate building in close proximity to Contractor's office.
 - 2. Contractor's office shall be of a size, and shall be furnished, so that it may be used for small progress meetings (seating for approximately 8 persons at table).
 - 3. Provide adequate artificial lighting, heating and cooling to provide comfortable conditions for occupants.
 - 4. Provide direct line telephone service for both voice communication and internet connection.
 - 5. Furnishings Required:
 - a. Contractor's Office: Racks and files for Contract Documents and for Record Documents; conference table and chairs; and desks and chairs as required by Contractor.

- b. Architect's Office: One lay-out drafting table 36" x 72" x 36" high; one standard desk with three drawers; chair and drafting stool. Provide one drawing rack for 30" x 42" drawings.
6. Provide high speed data access with internet access and wireless access point/router.

1.4 SANITARY FACILITIES

- A. Furnish temporary sanitary facilities and maintain in compliance with regulations of State Department of Health and other authorities having jurisdiction (minimum of one water closet and hand sink).

1.5 STORAGE FACILITIES

- A. Provide and maintain adequate weathertight lockable storage facilities, raised above the ground, with sides and top enclosed.
- B. Replace materials improperly stored and damaged by weathered conditions.
- C. Remove storage facilities when materials are stored within the structure in a weathertight condition.
- D. Allow for temporary freeze protection as needed.
- E. Address any storage needs for owner equipment, furniture, etc.

1.6 SIGNS

- A. Within three weeks after receipt of Notice to Proceed, provide one project identification sign and install in a location designated by the Owner at each campus.
- B. Fabricate the sign with sturdy wood framing and 3/4-inch-thick exterior grade plywood, with aluminum overlay and applied digitally printed vinyl sign, a minimum area of 64 cumulative square feet (8' x 8'). No other signs, except as allowed herein, shall be allowed to be displayed on the site. Contractor shall submit a scaled shop drawing of the sign, including all lettering, to the Owner for approval prior to installation.
- C. Project sign shall incorporate design layout as provided by Architect, and shall include:
 1. The official title of the Project as listed on Contract Documents.
 2. The name of the Owner as listed on Contract Documents.
 3. The names and titles of School Board Members and School Administrators.
 4. The names and titles of Architect.
 5. Identification number of the Contractor.
- D. Erect signs on 4" (102 mm) x 4" (102 mm) supports set firmly into the ground and well braced. The bottom of the sign is to be a minimum of 4' above grade, unless otherwise instructed by the Architect.
- E. Other signs required at the site:
 1. Warning, directional, and identification signs as required to indicate construction office location, and to facilitate campus operations that are impacted by construction.
- F. Contractor shall provide necessary signage to accommodate all Owner needs necessitated by the Work including temporary walking/driving routes, deliveries, etc.
- G. Allow no other signs to be displayed at the project site, unless authorized by the Owner.
- H. Secure and pay for all sign permits as required by local authorities.
- I. The sign shall remain the property of the Owner, and upon final completion, the Contractor shall remove the sign and deliver it to a location designated by the Owner or dispose of sign if directed by Owner.

1.7 BARRIERS

- A. Provide temporary barricades on all portions of the site as required to secure the construction area and affected areas of building and site.
- B. Provide approved barriers around trees and plants designated to remain. Protect against vehicular traffic, stored materials, dumping, chemically injurious materials, water puddling and continuous running water.
- C. Provide temporary partitions as needed to separate work areas from building occupants.

1.8 SECURITY

- A. Determine if and when watchmen are necessary for protection to the work and provide such services when necessary. Neither the provision of watchmen nor the failure to provide watchmen shall relieve the Contractor of responsibility in event of injury to persons or damage to property.

1.9 CLEANING

- A. **Trash Removal:** Clear the building and site daily of trash. When rapid accumulation occurs, make more frequent removals. Remove highly combustible trash such as paper and cardboard daily. Dumpsters will not be allowed to overflow and should be emptied on a regular basis. Subcontractors shall provide their own dumpsters for disposal of their debris.
- B. **Daily cleanup (renovation and new construction projects):** Daily cleanup is required both within construction area, and also for any areas on site that are used by Owner (sidewalks, drives, roads, corridors, etc.).
- C. **Disposition of Debris:** Remove debris from the site and make legal disposition. Locations for disposal shall be of the Contractor's choice within the above restriction. Neither debris nor material may be buried or burned at the site. Take necessary precautions to prevent accidental burning of materials by avoiding large accumulations of combustible materials.
- D. Refer to Section 01 71 50 for Preventive Housekeeping.

2.0 TEMPORARY FIRST AID FACILITIES

- A. Provide first aid equipment and supplies, with qualified personnel continuously available to render first aid at the site.
- B. Provide a sign, posted at the telephone, listing the telephone numbers for emergency medical services: physicians, ambulance services and hospitals.
- C. Provide and maintain one Automated External Defibrillator (AED) unit throughout duration of the project.

2.1 TEMPORARY FIRE PROTECTION

- A. Provide a fire protection and prevention program for employees and personnel at the site; and provide and maintain fire extinguishing equipment ready for instant use at all areas of the project, and at specific areas of critical fire hazard.
- B. **Equipment:**
 - 1. Hand extinguishers of the types and sizes recommended by the National Board of Fire Underwriters to control fires from particular hazards.
 - 2. Barrels of water with buckets designated for fire control purposes.
 - 3. Water hoses connected to an adequate water pressure and supply system.
 - 4. Construction period use of permanent fire protection system.

- C. Enforce Fire-safety Discipline:
 - 1. Store volatile materials in an isolated, protected location.
 - 2. Avoid accumulations of flammable debris and waste in or about the Project.
 - 3. Prohibit smoking on CFISD property and in the vicinity of hazardous conditions.
 - 4. Closely supervise welding and torch-cutting operations in the vicinity of combustible materials and volatile conditions, including roofing torching operations.
 - 5. Supervise locations and operations of portable heating units and fuel.
- D. Maintain fire extinguishing equipment in working condition, with current inspection certificate attached to each extinguisher.
- E. Contractor shall coordinate and comply with all requirements of Owner's personnel, as well as those of governing authorities.

2.2 CONSTRUCTION AIDS

- A. Provide construction aids and equipment required to assure safety for personnel and to facilitate the execution of the work; scaffolds, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes and other equipment.
- B. When permanent stair framing is in place, provide temporary treads, platforms and railings, for use by construction personnel.
- C. Maintain all equipment in a first-class, safe condition.

2.3 ACCESS ROADS AND PARKING AREAS

- A. Submit to CFISD for review and upon written approval, provide adequate temporary roads and walks to achieve all-weather car access into the site from public thoroughfares, and within and adjacent to the site, as necessary to provide interrupted access to field offices, work and storage areas. All temporary access roads and walks shall be removed upon completion of permanent facilities, or completion of construction.
- B. Provide adequate parking space for personnel and employees at the site, located to avoid interference with traffic adjacent school facilities and functions, work or storage areas, or with materials-handling equipment.
- C. Grade and provide drainage facilities to assure runoff of rainwater and to avoid blockage of flow from adjacent areas.

END OF SECTION

**SECTION 01 6210
SCHEDULE OF MATERIALS AND COLORS**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Information and procedures for color submission for color schedule.
- B. Schedule of Materials and Colors for pre-selected colors.

1.02 COLOR SCHEDULE PROCEDURES - PRE-BID SELECTED

- A. Contractor shall hold color samples requiring color selections until all are received. Only then shall the actual color samples be submitted to the Architect for selection. Colors samples matching color schedule shall not be submitted until field sample verifications are required.
 - 1. Contractor shall submit a complete transmittal letter with each related group of items. Each sample shall be properly labeled with the name of the project, contractor, manufacturer, and date of submission. Incomplete color submittals will be returned to the Contractor.
 - 2. The Contractor shall allow two (2) weeks after all colors are submitted for final Owner approval.

1.03 COLOR SCHEDULE PROCEDURES - POST-BID SELECTED

- A. Contractor shall hold all color samples until all items requiring color selections are received. Only then shall the actual color samples be submitted to the Architect for selection.
 - 1. Colors are noted on the drawings, and as specified. Where colors are not specified, Architect will select color with final color schedule.
 - 2. Contractor shall submit a complete transmittal letter with each related group of items. Each sample shall be properly labeled with the name of the project, contractor, manufacturer, and date of submission. Incomplete color submittals will be returned to the Contractor.
 - 3. The Contractor shall allow five (5) weeks after all colors are submitted for final Owner approval.

1.04 COLORS AND PATTERNS

- A. Unless the precise color and pattern is specifically called out in the Contract Documents, and whenever a choice of color or pattern is available in the specified products, submit accurate color and pattern charts to the Architect for selection.
- B. Verify all graphics with the Architect before proceeding. Graphics may need to be adjusted to reflect the same composition as that shown on the drawings.

1.05 SUBMITTALS

- A. Field Samples
 - 1. Once colors are selected, and received at the job site and prior to application or installation, the Contractor shall submit one (1) sample of each item to the Architect for verification of color and pattern.
 - 2. The Contractor shall allow five (5) working days from date of receipt of submission for verification notification.

1.06 SCHEDULING

- A. Contractor shall submit all products in a timely manner to avoid project delays for long lead time items.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers listed or named in a product or system specification are those manufacturers considered capable of manufacturing products conforming to the specification requirements.

- B. The "listing" or "naming" of a manufacturer does not imply "acceptance" or "approval" of any standard product of that manufacturer.
- C. Products listed or named manufacturers proposed for use shall be comparable in all respects to specified make or model number designation of named products and shall meet or exceed specification requirements of type, function, color, and quality.
- D. Where products are specified by naming model number and manufacturers only, the named products establish a standard of quality. Refer to individual specification sections for additional manufacturers and procedures.

2.02 MATERIALS - GENERAL

- A. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
 - 1. Provide selections made by Architect from manufacturer's full range of standard colors, textures, and patterns for products of type indicated.
 - 2. Provide trim and accessories that match color and finish unless noted otherwise.
 - 3. Where contractor is submitting a substitution, contractor shall provide color equal to that specified. Substituted colors are not considered approved unless published in writing in Addendum prior to bid. If substituted product does not match specified color, contractor shall provide custom color as required at no additional cost to the owner.

PART 3 - EXECUTION

3.01 APPLICATION

- A. Paint any vents, grilles, piping, columns, etc. the same color as the wall or graphic unless noted otherwise.
- B. Unless otherwise noted, all accent paint shall terminate at an inside corner. If wall terminates at storefront, wrap paint to meet edge of storefront.
- C. All exposed concrete shall be sealed.

3.02 SCHEDULE OF MATERIALS AND COLORS

- A. General Notes:
 - 1. All paint colors are subject to last shade adjustments.
 - 2. The Contractor shall submit samples of all finishes for comparison and approval of colors to the items listed in the color schedule.
 - 3. Where multiple buildings occur in one project, all materials and finishes may not apply to all buildings. Refer to the drawings for material and finish locations.
 - 4. The General Contractor shall verify all colors selections and numbers and note any drawings changes that may have occurred. Notify the Architect of any discrepancies found within 14 days.
 - 5. Notes stating "See Drawings for Locations" refer to the Construction Documents.
 - 6. Where note "pending submittal" occurs, Contractor shall submit samples of the material that meets the Standards outlined in the appropriate specification for Architect's review and selection. For materials with more than one color, texture or pattern available, Contractor shall submit the Manufacturer's full range of colors, texture and patterns.
 - 7. If there is a conflict between the product, material or color specified in this Legend and the product's specification Section within the Division, notify the Architect immediately. The Schedule of Materials and Colors shall govern unless a written clarification is given.
- B. See DRAWINGS for Schedule of Materials and Colors for specific product details and requirements.

END OF SECTION

SECTION 01 71 23

FIELD ENGINEERING

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Measures to ensure adequate quality control and quality assurance for all Work in accordance with Conditions of the Contract, as specified herein, and with the quality control and quality assurance requirements of each Specification Section, and authorities having jurisdiction.

1.2 RELATED SECTIONS

- A. All Sections of Work requiring layout, survey, reference points and their verification and protection, and quality control and assurance monitoring requirements.

1.3 DEFINITIONS

- A. Survey and Field Engineering: Wherever the terms “Survey”, “Field Engineering” or any derivative thereof, or similar term appears within this Section, they mean one and the same, and shall mean the survey or field engineering work performed by the Field Engineer as defined below and is separate from that of the survey work provided by the Owner.
- B. Field Engineer: Wherever the term “Field Engineer” or any derivative thereof, or similar term appears in the Contract Documents, it shall refer to the General Contractor’s employee(s) that are expert in, routinely engaged in, and have at least five (5) years experience in, the practice of construction project field engineering, building and project layout, construction measurements and monitoring, etc.
- C. “Construction Surveyor”: Wherever the term “Construction Surveyor”, or any derivative thereof, or similar term appears in the Contract Documents, the entity (person or firm) licensed as a Registered Professional Land Surveyor or Professional Engineer of the discipline required for specific service on the Project in the State in which the Project occurs, with five (5) years minimum experience, and meeting all applicable regulations of the State in which the Project occurs and Department of Labor, and other authorities having jurisdiction to perform the Work. To avoid any misunderstanding or lack of interpretation, the entity responsible for performing the Work of this Section shall be employed by the General Contractor, and the responsibility, including methods and means, is totally that of the General Contractor.
- D. Quality Control and Quality Assurance: Wherever the terms “Quality Control”, “Quality Assurance” or any derivative thereof, or similar term appears in the Contract Documents, they mean one and the same, and shall mean an aggregate of activities of the General Contractor, such as design analysis and statistical sampling with inspection for defects, designed to ensure adequate quality in materials and workmanship whether factory manufactured or jobsite produced.

1.4 QUALITY CONTROL AND QUALITY ASSURANCE

- A. Employ a Construction Surveyor complying with the definition above and acceptable to the Owner and Architect, to perform all Construction Surveying. Provide full responsibility for the Construction Surveyor and accuracy of the performance of all items of Work shown on Drawings, specified herein, or in other Specification Sections.

SUBMITTALS FOR REVIEW

- A. Submit name, address, telephone number, fax number, and registration number of the proposed Construction Surveyor prior to starting Work of this Section.
- B. Submit evidence of Construction Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate, if different from Construction Manager's.
- C. Upon request by Architect, submit documentation verifying accuracy of all Survey Work, including a certificate sealed and signed by the Construction Surveyor, that the elevations and locations of the Work are in conformance with Contract Documents and such information has been incorporated into the Project Record Documents.
- D. Submit Project Record Documents under provisions of Section 01 77 00, Closeout Procedures.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of discrepancies discovered.

3.2 SURVEY REFERENCE POINTS

- A. Locate and protect survey control and reference points.
- B. Control datum for survey is that established by the Owner provided survey and as indicated on Drawings.
- C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- E. Replace dislocated survey control points based on original Owner's survey control. Make no changes without prior written permission of Architect.

3.3 FIELD ENGINEERING AND CONSTRUCTION SURVEYOR REQUIREMENTS

- A. Establish a minimum of two (2) permanent benchmarks on site, referenced to established control points. Record locations, with horizontal and vertical data, on Project Record Documents.
- B. Field Engineer shall establish elevations, lines and levels. Locate, lay out, and monitor by instrumentation and similar appropriate means Work, including, but not be limited to:
 - 1. elevations, and layout of property lines and easements;
 - 2. site drainage, including storm water control and pollution prevention measures, slopes, swales, and invert elevations;
 - 3. limits of clearing and grubbing, including identification of trees and planting to be removed and methods for protection of those to remain;
 - 4. excavations, fill and topsoil placement, and all (rough and finish) grades;

5. trenching and trench safety;
 6. utility locations;
 7. concrete and asphaltic concrete paving, curbs, ramps, and other site improvements, as applicable;
 8. grid or axis for structures, batter board locations;
 9. elevation, grade controls, and layout of building foundation and grade beams, column locations, base plates, embedded items, depressions, formwork, and openings in concrete, including all interior finish grades;
 10. elevations of structural steel, including, steel joists/trusses, steel decks, and associated miscellaneous metals;
 11. elevations and layout of masonry, including concrete masonry units (CMU), face brick, cast stone, and other elements built-in masonry.
 12. elevations and slopes of roofing, including those for lightweight insulating concrete deck system, if applicable.
 13. elevations and layout of work as required to ensure proper operation, clearances, and tolerances, including conveying systems, plumbing and mechanical work; and
 14. monitoring of movement and protection of existing or adjacent structures, as applicable.
- C. Throughout course of Work, verify existing conditions and layouts by same means as originally used to ensure conformance with design requirements and details. Notify Architect immediately, if discrepancies are found.
- D. Provide one (1) copy each of reduced Field Engineer's notes to the Architect, Owner, Construction Surveyor, and affected Consultant within four (4) working days of completion of each portion of the Field Engineering Work.
- E. Field Engineer's notes shall be clear and complete. The Field Engineer shall be available at no expense to the Owner, Architect, or Consultants for note interpretation, if required.
- F. Field Engineer shall perform surveys to determine quantities of unit cost work, including control surveys to establish measurement reference lines. Notify Architect prior to starting work.
- G. Provide Construction Surveying services. Utilize recognized engineering survey practices.
- H. Construction Surveyor shall verify and record/document their findings, on a drawn survey at a scale matching that of the original Contract Documents, for the following:
1. All property lines and corners
 2. All building corners
 3. All paving corners
 4. Finish floor of all/each buildings
 5. Invert elevations, flow lines for all site drainage structures and improvements
- I. Payment for earthwork quantities shall be for materials in place, compacted, and determined by neat line method.
- J. Provide the Owner a reproducible hard copy and digital/electronic file copy of all the Construction Surveyor's work.

3.4 PROJECT RECORD DOCUMENTS

- A. Maintain a complete and accurate log of control and Field Engineer work as it progresses.
- B. Upon completion of Work, including, but not limited to earthwork, formwork, foundation, structural steel erection, and major site improvements, prepare Project Record Documents illustrating dimensions, locations, angles, and elevations of construction and site work.
- C. Submit Project Record Documents as specified in Paragraph 1.5.

END OF SECTION

SECTION 01 71 50

PREVENTIVE HOUSEKEEPING AND FINAL CARPET CLEANING

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. Cleaning of new and existing Tandus Powerbond carpet within the Project work area at the end of each work window upon substantial completion of work scheduled each day. Work window shall be determined by and coordinated with Owner.
- B. Clean entire area of building where construction or scope of work occurs, and all areas affected by construction activities including but not limited to dirt, debris and construction dust.
- C. Preventive Daily Housekeeping. The following are intended as a guide to facilitate the daily maintenance and cleanliness of the construction site, including but not limited to:
 - 1. Renovations involving the commons cafeteria where the stage curtain may be exposed/soiled by construction materials, dirt, dust etc. the curtain shall be removed prior to construction and stored according to curtain Manufacturer's recommended procedures and methods. Contractor reinstall after final cleaning. Contractor is responsible for curtain cleaning should it become soiled from construction activities per Curtain Manufacturer's methods.
 - 2. Contractor to segregate phased and/or areas of construction from all other areas of the building with a sealed, airtight construction barrier.
 - 3. Contractor shall provide additional AHU air filtration to protect existing Owner HVAC systems and other areas of building from becoming soiled from construction activities and dust. Should construction dirt and dust accumulate in affected construction areas, Contractor shall provide final cleaning of those spaces.
 - 4. Contractor is to prevent daily accumulation of construction dust or any other material that can cause any safety hazard.
 - 5. Contractor to eliminate, as practical as possible, tracking of dirt and debris prior to entering building each time.
 - 6. In an effort to protect existing flooring surfaces, Contractor is responsible for providing adhesive plastic sheeting and Masonite and/or plywood to prevent accumulation of all contaminants, including but not limited to: dirt, damaging foot traffic, lift equipment, machinery oil, etc. Continuously inspect and provide replacement/maintenance as needed of sheeting and Masonite/plywood as appropriate to construction intensity.
 - 7. Daily cleaning and maintenance of existing carpet to utilize procedure itemized in subsection 3.1 prior to cold water extraction.

PART 2 – PRODUCTS

2.1 CERTIFIED MAINTENANCE PARTNERS

- A. Corporate Care
Phone: 713-692-6300
Attn: Sean Barnett
- B. GCA Services Group
Phone: 972-276-5858
Attn: Dub Spencer

- C. Texan Floor Service
Phone: 713-956-9966
Attn: Jeff Hill

2.2 MATERIALS

- A. Cleaning Solutions: Cleaning solutions shall be used according to manufacturer's instructions. Review the material safety data sheets (MSDS) and/or safety data sheet (SDS), and product labels on solutions, being aware of any precautions and usage guidelines.
 - 1. Below are the minimum requirements for cleaning solutions to be used on C&A carpet. Contact your supplier to assure that these guidelines are met:
 - a. Shall be safe and non-toxic.
 - b. Shall contain no optical brighteners.
 - c. Shall have a pH between 5 and 9 diluted for normal cleaning.
 - d. Do not leave a sticky or oily residue when dried.
 - e. Will not damage carpet's fiber or color.
 - f. Will not promote rapid soiling.
 - 2. Conduct the following test to evaluate the type of residue a solution leaves behind:
 - a. Prepare the solution and pour in a pan.
 - b. Place in direct sunlight and allow to evaporate. If it leaves a sticky or oily residue, do not use. The carpet manufacturer can provide approved cleaning agents and deodorizers for the specific carpet. These cleaners have been tested for appropriate pH levels, absence of optical brighteners and zero resoil potential.

2.3 EQUIPMENT

- A. Equipment: Use the effective, well-functioning equipment:
 - 1. Vacuum Cleaner: Use a commercial vacuum cleaner that exceeds the established industry standards for soil removal. For improved indoor air quality, the vacuum shall have high efficiency filtration and shall emit minimal particles into the air. (The carpet manufacturer can provide a list of suggested vacuum cleaners.)
 - 2. Pile Lifter: Use a pile lifter to assist in the cleaning process to aggressively lift the pile fiber and loosen attached soil prior to vacuuming. Because of this aggressiveness, caution must be used when cleaning C&A's Syntex® products. (The carpet manufacturer can provide a list of suggested pile lifters.)
 - 3. Extractors: Provide hot water extraction for final deep cleaning and maintenance.
 - a. Selection should be based upon the needs of the facility. In general, the following minimum performance should be considered:
 - 1) Extractor should be C&A approved and capable of extracting a maximum volume of water injected into carpet pile fiber.
 - 2) Components should be made of a material that is non-corrosive and will not rust or deteriorate in the presence of water and/or cleaning solutions.
 - 3) Extractor should be able to generate a minimum of 50 pounds per square inch (psi) of pressure and should not exceed 400 psi.
 - 4) The carpet manufacturer can provide a list of suggested extractors.
 - 4. Portable Air Mover:
 - a. Carpet can dry within 2 to 3 hours in most environments. Drying time should never exceed 12 hours.
 - b. When extreme environmental conditions exist (relative humidity exceeds 65%), an air mover or drying fan should be used to accelerate drying time.
 - c. The carpet manufacturer can provide a list of suggested portable air movers

PART 3 – EXECUTION

3.1 PROCEDURE

- A. Cleaning Procedures:
1. Vacuuming
 - a. Make sure the vacuum cleaner is in proper working order before each use. (Clean all components regularly.)
 - b. Use slow, overlapping passes. Slowing the vacuum down allows the suction to loosen and remove the embedded dry soil that can abrade and damage fibers.
 - c. Pay careful attention to the “pull” stroke. More soil is removed in this action than in the forward stroke.
 - d. Empty vacuum bags when they become half full to improve soil removal.
 - e. Replace nylon brushes at the first sign of wear.
 - f. Use only original equipment manufacturer parts for consistent performance.
 2. Spill Removal
 - a. Spills may require cleaning solutions to remove.
 - b. The spill/liquid should be blotted into paper or cloth towels.
 - c. Place several layers of towels over the spill and apply pressure until all of the excess liquid has been removed.
 - d. Use a portable spot removal extractor with cold water solution.
 3. Spot Removal
 - a. Determine if the spot is a water-soluble or oil-based stain by applying clean water and blot with absorbent towel. Water-soluble spots will transfer to the towel; oil-based spots will not. Clean spot using one of the following methods:
 - 1) For water-based spots: Continue rinsing with water as long as there is transfer to the towel. A cleaning agent may not be necessary if water continues to remove the spot. If a cleaning agent is needed, apply a Manufacturer approved (Collins and Aikman for TanduS carpets) spot lifter to the area and allow to soak for 5 minutes. Then, flush thoroughly with water until all detergent residue has been removed. Repeat this process until the spot is removed.
 - 2) For oil-based spots: After blotting to remove excess liquid, apply a non-water based dry-cleaning solvent* to a towel and apply to the spot. (Applying a dry-cleaning solvent directly to the Carpet surface may allow the spot to spread.) Work from the outer edges of the spot to limit spreading. Continue to reapply solution in this manner until the spot is completely removed. Then flush thoroughly with water until all residue has been removed. In case of permanent stains, repairs may be necessary.*Dry-cleaning solvents denote isopropyl alcohol, denatured alcohol and other, non-water-based cleaning solutions.
 4. Extraction
 - a. In addition to vacuuming and spot removal, extraction will help maintain Carpet’s appearance.
 - b. The procedure for effective soil removal is as follows:
 - 1) Pile lift all heavy soiling areas.
 - 2) Thoroughly vacuum the entire area to remove dry soil.
 - 3) Never use detergent in the extractor rinse tank.
 - 4) Pre-spray the area with an approved pre-spray solution.
 - 5) Use agitation for improved cleaning results.
 - 6) Allow the solution to remain undisturbed for 5 to 10 minutes. This will make the soil easier to remove.
 - 7) Extract the area thoroughly to rinse and remove all the detergent and soil.
 - 8) Repeat until recovery water is relatively clean.
 - 9) Place air movers on the area to expedite the drying time.
 - 10) Limit foot traffic on the area until dry.
 - c. Extraction equipment guidelines:

- 1) Make sure extractor is in proper working order.
 - 2) Disinfect freshwater tank and recovery tank on a weekly basis.
 - 3) Replace nylon brushes at the first sign of wear.
 - 4) Use only original equipment manufacturer parts for consistent performance.
5. Tape Residue Removal
- 1) Following removal of carpet and flooring protective measures, including but not limited to plastic sheeting, adhesive plastic sheeting, Masonite, tape, etc., Contractor is responsible for complete removal of tape residue (per flooring manufacturer recommendations) from flooring surfaces prior to final cleaning.

3.2 SCHEDULE

- A. Traffic Patterns: Identify and evaluate the traffic patterns in the facility and get approval from Owner. Using a floor plan of the facility, color code the plan to identify each of the areas.
- B. Cleaning Schedule:
1. Track-Off Areas: Areas where outside soil is tracked in (entrances, lobbies, restrooms, elevators, and areas next to hard-surface flooring). These areas require specific attention.
 - a. Pre-vacuum prior to spot cleaning
 - b. Spot clean to remove entrenched stains
 - c. Vacuum again using multiple passes
 - d. Pile lift to loosen embedded soil prior to extraction
 - e. Wet extract in each direction using multiple passes to achieve desired appearance level
 - f. Spot clean as necessary
 - g. Vacuum
 2. Heavy Traffic Zones: Areas that experience more than 1,000 foot traffics per day (staging areas, traffic lanes, pivot points and funnel areas)
 - a. Vacuum using multiple passes
 - b. Pile lift to loosen embedded soil prior to extraction
 - c. Wet extract to achieve desired appearance level
 - d. Spot clean as necessary
 - e. Vacuum
 3. Moderate Traffic Zones: Areas that experience 500 to 1,000 foot traffics per day (secondary hallways, administrative areas, offices, and light-use common areas)
 - a. Vacuum using multiple passes
 - b. Pile lift to loosen embedded soil prior to extraction
 - c. Wet extract to achieve desired appearance level
 - d. Spot clean as necessary
 - e. Vacuum
 4. Light Traffic Zones: Areas that experience less than 500-foot traffics per day (conference rooms, areas outside of traffic lanes, and limited use-area)
 - a. Vacuum using multiple passes
 - b. Wet extract as necessary to achieve desired appearance level
 - c. Spot clean as necessary
 - d. Vacuum

5. Areas Prone to Spots and Stains: (break rooms, coffee areas and areas near kitchens)
 - a. Pre-vacuum prior to spot cleaning
 - b. Spot clean to remove undesirable stains
 - c. Pile lift and wet extract as required according to traffic zone identification above
 - d. Spot clean again as necessary
 - e. Vacuum

END OF SECTION

SECTION 01 77 00

GUARANTEES, CERTIFICATES AND CLOSE-OUT

CONDITIONS OF THE CONTRACT, SUPPLEMENTARY CONDITIONS AND DIVISION I APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Certain procedures have been developed and are required to fulfill all provisions of the Owner-Contractor Agreement with respect to contract Final Completion and Contract Close-Out for the work/project to be 100% complete.
- B. Refer to AIA Document A201™-2017, General Conditions of the Contract for Construction; as amended and Section CB – Supplementary Conditions of the Contract for Construction; as amended for additional information and requirements.

PART 2 - SUBSTANTIAL COMPLETION

2.1 GENERAL

- A. Projects that involve phase sequential construction of major definable areas of projects that involve separate work on multiple campuses shall have Certificates of Substantial Completion issued for each phase or campus, as applicable and agreed upon by the Owner and Contractor. All conditions for Substantial Completion, including liquidated damages, shall apply for each date of Substantial Completion for each phase or campus, as applicable.
- B. Individual Substantial Completion Dates for each phase or campus shall be determined and agreed upon by the Owner, Architect and Contractor. Where an Alternative Proposal dictating a required, guaranteed completion date (dates) is included in the Proposal Form and accepted by the Owner, the date(s) stated therein shall establish the Substantial Completion Dates to be incorporated into the Agreement.
- C. The following items are a partial list of requirements, as applicable to the Project, which must be completed prior to establishment of a Substantial Completion date. Refer to substantial completion checklist contained within the AIA Document A201™-2017, General Conditions of the Contract for Construction as amended for a complete list.
 - 1. All fire alarm system components must be completed and demonstrated to the Owner.
 - 2. All inspections by government authorities having jurisdiction over the project must have been finalized, any remedial work required by them must have been completed, and Certificates of Occupancy, local fire marshal and health department approval certificates and similar governmental approval forms must have been issued and copies delivered to the Owner and Architect.
 - 3. All exterior clean-up and landscaping must be complete, including required stand of grass mowed, edged, weeded, and fertilized.
 - 4. All interior shall have been completed and cleaned except minor items which, if complete after occupancy, will not, in the Owner's opinion, cause interference to the Owner's use of the building or any portion thereof. Contractor shall provide list of these specific items, which include punch list and completion items. A significantly large number of items to be completed or corrected will preclude the Architect from issuing a Certificate of Substantial Completion. The Owner and Architect shall be the sole judge of what constitutes a significantly large number of items.
 - 5. All third-party HVAC air and water balancing must be complete.

6. All energy management systems must be complete, fully operational and demonstrated to the Owner, with graphics transferred to the main server.
 7. All emergency/standby generator and low voltage lighting control systems must be complete, fully operational and demonstrated to the Owner.
 8. All security systems must be complete, fully operational and demonstrated to the Owner, and must be monitorable from the District's central Police/Security Center.
 9. All school communications equipment, telephone systems and P.A. systems must be complete and demonstrated to the Owner.
 10. All final lockset cores must be installed and all final Owner directed keying completed.
 11. All room plaques and exterior signage must be complete.
 12. All Owner demonstrations must be completed including kitchen equipment, HVAC equipment, plumbing equipment, and electrical equipment and all life safety systems.
 13. A final certificate of occupancy must be signed by the Contractor and delivered to the Owner.
 14. All operation and maintenance manuals are delivered and approved by Architect and Owner ("D-slant" ring binders in duplicate).
 15. Health Department Inspections and Municipal Utility District (MUD) and Drainage District and County approvals must be provided.
 16. All other reports, testing results, certifications, studies, etc. required by Contract Documents.
- D. Final Cleaning:
1. The work area shall be thoroughly cleaned inside and outside. Cleaning includes removal of smudges, marks, stains, fingerprints, soil, dirt, spots, dust, lint, and other foreign materials from finished and exposed surfaces. Refer to Section 01 71 50 for final clean requirements of remodel areas and carpet.
 2. Remove all temporary facilities.
- E. In order for the project, a major portion thereof, a project phase or project campus to be considered Substantially Complete, the following conditions must be met:
1. All inspections by governmental authorities having jurisdiction over the project must have been finalized; any remedial work required by them must have been completed; and Certificates of Occupancy and similar governmental approval forms must have been issued and copies delivered to the Owner and Architect.
 2. All work, interior and exterior, shall have been completed and cleaned except minor items (Punch List) which, if completed after occupancy, will not, in the Owner's opinion, cause any interference to the Owner's use of the building or any portion thereof.
 3. All items stipulated in 2.1-C above.
- F. The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the Owner, at his sole discretion, may make (partial) payment of retainage applying to such work or designated portion thereof which is 100% complete and accepted by the Owner. Such payment, if made at all, shall be adjusted in the Owner's favor for work that is incomplete or not in accordance with the requirements of the Contract Documents.
- G. The date of Substantial Completion shall represent day one (1) of the thirty (30) day period to complete all work and correct all deficiencies contained in the Punch List and the ninety (90) day period allowed for complete Contract Close-Out as described below.

2.2 PUNCH LIST

- A. A comprehensive list prepared by the Contractor prior to Substantial Completion, and attached thereto, to establish all items to be corrected, or limited items of work to be completed, if any. This list is intended to represent a limited number of items needing attention.
- B. Punch lists shall be furnished to the Architect in Microsoft Excel and PDF formats. The punch list shall be in matrix form and shall include the following information for each punch list item:

1. Room number or other suitable location identifier
 2. Description of the work
 3. Sub-contractor/trade sign-off that the work has been verified to be 100% complete and in accordance with the Contract Documents
 4. Sub-contractor/ trade sign-off date
 5. General contractor sign-off that the work has been verified to be 100% complete and in accordance with the Contract Documents
 6. General contractor/trade sign-off date
 7. A/E consultant sign-off
 8. A/E consultant sign-off date
 9. If requested by the Owner, provide two additional similar columns for their sign-off
 10. In the case of excessive repetition of the same item at various locations, the punch list may contain "general notes/items" that shall be applied to the entire project; and it shall be the responsibility of the contractor/sub-contractor to thoroughly examine the entire project and make corrective measures at all applicable locations.
- C. Should the Architect determine that the Contractor's punch list lacks sufficient detail or requires extensive supplementation, the punch list will be returned to the Contractor for re- inspection and revision. The date of Substantial Completion will be delayed until the punch list submitted is a reasonable representation of the work to be done.
- D. A significantly large number of items to be completed or corrected will preclude the Architect from issuing a Certificate of Substantial Completion. The Owner and Architect will be the sole judge of what constitutes a significantly large number of items. It is anticipated that the detailed list of items of work to be completed or corrected at the Date of Substantial Completion.
- E. The Contractor's superintendent shall participate in the preparation of the Contractor's punch list that is submitted to the Architect and Owner for supplementation. Upon receipt, the Architect and Consultants shall perform a spot review to determine the adequacy and completeness of the Contractor's punch list.
- F. Upon receipt of an acceptable Contractor's punch list, the Contractor's Superintendent shall accompany the Architect, his Consultants, and the Owner (at his discretion) during their observation and the preparation of their supplements to the Contractor's punch list.
1. The Superintendent shall record or otherwise take note of all supplementary items.
 2. The Architect will endeavor to furnish to the Contractor typed, hand written or recorded supplements to the punch list in a prompt manner; however, any delay in the Contractor's receiving said supplements from the Architect will not be cause for a claim for additional cost or extension of time as the Contractor's Superintendent shall have been in attendance during the inspections of the Architect and his Consultants and will have been expected to take his own notes.

2.3 OPERATIONS AND MAINTENANCE MANUALS

- A. Operation and Maintenance (O&M) Manuals shall be delivered prior to, and are a condition of, Substantial Completion to allow the Owner the benefit of having the manuals for on-site training and start-up procedures provided by the Contractor.
- B. Operation and Maintenance (O&M) Manuals shall provide concise descriptions, technical information, principles of operation; operating instructions, maintenance instructions and schedules, MSDS sheets, and other information that will enable the proper on-going operation and maintenance of the material and/or assembly.
- C. Separate O&M Manuals shall be provided for the following as applicable to the project scope of work:

1. Architectural materials, equipment and/or assemblies
 2. Food services materials, equipment and/or assemblies
 3. Mechanical materials, equipment and/or assemblies
 4. Plumbing materials, equipment and/or assemblies
 5. Electrical materials, equipment and/or assemblies
 6. Low-voltage systems materials, equipment and/or assemblies
 7. Theater lighting/sound systems materials, equipment and/or assemblies
- D. Provide O&M Manuals/information for all materials, equipment and/or assemblies where required in individual sections of specifications.
- E. Each O&M Manual shall contain a cover and spine label depicting contents as delineated in paragraph C above; and within each Manual shall be organized in numerical order corresponding to specification sections.
- F. O&M Manuals shall be provided in 3-ring binders similar to close-out manuals described above.
1. O&M manuals shall contain a table of contents listing the specification number with corresponding general description of the material, equipment, and/or assembly included in the manual.
 2. The indexed sections shall be divided and identified by tabbing each section as listed in the index.
- G. Deliverables:
1. Provide electronic copy of all O&M manuals for review. Deliver A/E Consultant O&M Manuals directly to the relative A/E Consultant with a copy of the transmittal to the Architect.
 2. Resubmit as necessary to obtain final acceptance of Manuals.
 3. Once all corrections have been made and the O&M Manuals found to be acceptable, provide one (1) hard copy of each binder and one (1) PDF format electronic copy of each binder to the Architect for transfer to the Owner.

2.4 SUBSTANTIAL COMPLETION SCHEDULE

- A. After the date of Substantial Completion of the project as evidenced by the Certificate of Substantial Completion, AIA document G704-2000, the Contractor will be allowed a period of thirty (30) days, unless extended by mutual agreement or provision of the Contract, within which to complete all work and correct all deficiencies contained in the Punch List attached to the Certificate of Substantial Completion. It is incumbent upon the Contractor to request Substantial Completion **only** when there is assurance that all work included on the Punch List shall be completed within the thirty (30) day time frame.
1. In the event the Owner must take occupancy of the project prior to Contractor's completion of the punch list, the Contractor shall make all adjustments necessary to schedule the work to allow full and normal operation of the project by the Owner.
 2. Where this requires work outside of normal business hours, the work shall be provided at no additional cost to the Owner.
- B. Upon Contractor's and sub-contractor's verification that all punch list items have been 100% completed, the Contractor shall notify the Architect and the Architect and consultant(s) shall conduct an on-site observation to verify that all items are 100% complete.
1. On-site verifications for partial completions, if any, shall be conducted by the Architect at the Architect's discretion.
 2. If any items shown to be complete by the Contractor are found not to be complete by the Architect, the observation shall be stopped, with such notification to the Contractor.
 3. Contractor's requested punch list observations by the Architect shall be limited to a maximum of two (2) per punch list.

- C. If the Contractor fails to complete all work on the punch list within thirty (30) days after the Substantial Completion date, Contractor shall be required to attend weekly meetings at the project site or Owner's office until such time as 100% of the punch list items are completed and accepted by the Owner. During this time the Contractor will be charged from the Owner's, Architect's and any A/E Consultant's time associated with achieving completion of the punch list.
1. Billable time shall include, without limitation, travel time, meeting time, document preparation, document review, and re-inspection of on-site conditions.
 2. The weekly meetings shall include a minimum of two (2) hours charge per participant.
- D. Owner billable time shall be deducted from the Contractor's Final Payment or separately invoiced to the Contractor at Owner's option. Owner billable hourly rates shall be as follows:
1. Assistant Superintendent: \$200.00 per hour
 2. Director: \$175.00 per hour
 3. Project Manager: \$150.00 per hour
 4. Project Coordinator: \$120.00 per hour
 5. Administration/Secretarial: \$50.00 per hour
- E. Architect and A/E Consultant billable time shall be invoiced to the Contractor by the Architect. A/E billable rates shall be as follows:
1. A/E Principal: \$175.00 per hour
 2. A/E Project Manager: \$150.00 per hour
 3. Staff Architect/Consultant: \$120.00 per hour
 4. A/E Field Representative: \$100.00 per hour
 5. Administration/Secretarial: \$50.00 per hour

PART 3- PRODUCTS

- 3.1 Not used.

PART 4 - CONTRACT CLOSE-OUT

4.1 GENERAL

- A. Upon issuance of the (final) Certificate of Substantial Completion, and per the Owner- Contractor Agreement, the Contractor will be allowed a period of ninety (90) days within which to complete all Contract Close-Out requirements, unless extended by mutual agreement or provision of the Contract.
- B. In addition to all work and requirements described for Substantial Completion, in order to achieve Contract Close-Out, the Contractor shall submit all Close-Out documents per Form AO.

Record Document

- C. Final/ 100% release of retainage will not be authorized by the Architect until the Contractor completes all of the requirements for Contract Close-out; and until all expenses incurred and to be paid by the Contractor have been paid in full.
- D. It is the Contractor's sole responsibility prior to submission to verify that Close-Out documents being submitted for review and acceptance are 100% complete and accurate. The Owner/Architect reserves the right to reject any incomplete close-out documents.
1. Upon discovery by the Architect that Close-Out documents are incomplete and/or inaccurate, the Architect's review shall cease, and the Contractor shall be so notified.

2. The A/E Consultants' will provide a comprehensive list of possible missing and/or incorrect items needed.
- E. It is desirable and beneficial to submit all Close-Out documents as a single submission; however, Close-Out documents may be submitted separately in four (4) deliverables as follows:
1. Close-Out Documents Manual
 2. Operations and Maintenance Manuals (required prior to Substantial Completion)
 3. Record Drawings
 4. Owner's Record Copy of Submittals (one (1) flash drive in PDF format)
- F. Close Out Tracking
1. Contractor shall track the progress of project closeout utilizing excel spreadsheets which will be provided by the Architect (see examples attached at the end of this Spec Section).
 2. Contractor shall update closeout tracking spreadsheets weekly and submit electronic copy to Architect twenty-four hours prior to the weekly closeout review meetings.
 3. Master Closeout Checklist represents all items required to be provided by the Contractor to the Owner at the conclusion of the project. It is more general in nature and only includes a status of the closeout item in question. It does not drill down into the details of when the item was submitted, why it was rejected, when it was approved, etc. This checklist will be used throughout the project to track all closeout deliverables.
 4. Detailed Checklists are more comprehensive lists developed for each section of the closeout requirements. These lists are used by the Contractor to identify and track every deliverable required from each subcontractor. This list will contain a separate entry for each item that is required from each and every subcontractor. It should include the specification section that lists the requirement, a description of the item, responsible subcontractor, and the dates that the items were requested, received, and transmitted to the Owner. The information included in these detailed checklists is used to update the Master Closeout Checklist.
 5. A sample of the Master and Detailed Checklists are attached at the end of this Spec Section. An excel file with the checklists will be provided by Architect.

4.2 CLOSE-OUT MANUALS FORMAT

- A. All close-out documents shall be submitted in CFISD provided digital format with detailed table of contents, intext tabs corresponding to the table of contents.
1. The close-out documents must be neatly organized and easily useable, as determined by the Architect and Owner.
 2. At completion and final review, submit one (1) electronic PDF file and one (1) flash drive containing close-outs.

Table of Contents

Part 1: Close-Out Log

- a. Project Checklist – Form AO
- b. Close Out Log

Part 2: Project Directory

- a. Project Team (architect, engineer, contractor, consultants)
- b. List of Final Subcontractors/Suppliers/Local Representatives (by Specification Section)

Part 3: Close-out Documents and Affidavits

- a. AIA G707 - Consent of Surety to Final Payment
- b. AIA G706 - Contractor's Affidavit of Payment of Debts and Claims
- c. AIA G706A - Contractor's Affidavit of Release of Liens
- d. Subcontractor's Release of Lien

Part 4: Project Documents and Certificates

- a. AIA G704 - Certificate of Substantial Completion
- b. Punch List / Architects Letter Confirming Completed Punch List
- c. Copy of All Permits
- d. Copy of Final Utility Bill or Letter of Transfer
- e. Certificate of Occupancy
- f. Certification of Project Compliance
- g. Hazardous Material Certificate
- h. Asbestos Manifest / TDLR Inspection / EAB Letter / Structural Letter / Material Testing Letter(s) / Commissioning / other Consultants
- i. Form AQ - Certificate of Final Completion

Part 5: Warranties (Compiled Sequentially by Specification)

- a. General Contractor's Warranty
- b. Subcontractor's Warranty
- c. Extended Warranties & Maintenance / Service Agreements

Part 6: Insurance (General Contractor / Subcontractor)

- a. Continued Coverage
- b. Worker's Compensation Certificate

Part 7: Receipts

- a. Extra Stock by Division
- b. Keys
- c. Paint Mix Cards

Part 8: Record Documents

- a. Demonstration and Training Sign-in Sheets by Division with Digital Video
- b. Operations & Maintenance Manuals and Record Drawing Transmittal(s)

4.3 WARRANTIES

- A. All guarantees and warranties required by the Contract Documents shall establish the date of Substantial Completion as day one (1) of the required warranty period; regardless of how long the product, assembly or work has been installed or in operation prior to Substantial Completion.

1. Coordinate with subcontractors and material suppliers to account for provision in their original proposal/bid amount, if necessary.
- B. Contractor's One-Year Warranty: The Contract requires the General Contractor to warrant ALL materials and work provided/furnished for a period of one (1) year following the date of Substantial Completion.
 1. The one-year general warranty shall include all labor, material and delivery costs required to correct defective material or installation during the Warranty period.
- C. Sub-Contractor's One-Year Warranty: each sub-contractor that performed work on the project shall be required to submit a one-year warranty similar to the above Contractor's One-Year Warranty for their specific work provided.
- D. Extended Warranties: In addition to the General Contractors and subcontractors' one-year warranty, other required guarantees shall be included in the Close-Out Binder in original issue form. All extended warranties shall begin on the Substantial Completion date; and shall include all labor, material and delivery costs required to correct defective material or installation for the entire required extended warranty period, as specified in the respective specification section.

4.4 RECORD DRAWINGS:

- A. Upon Substantial Completion, the Contractor shall be furnished, at no charge, a complete set of electronic files in AutoCAD release 2018 or later, and Revit if applicable, of all drawings included in the Contract Documents. The title blocks shall be stripped of all logos, disclaimers and licensed seals of the Architect and Consultants.
 1. Throughout the construction phase, Architect's and Consultant's supplemental drawings/sketches provided to the Contractor in AutoCAD and Revit format shall be provided to the Contractor electronically and shall be incorporated in the electronic files by the Contractor.
- B. Upon request, the Architect and/or Consultants shall assist the Contractor with understanding the structure and composition of the electronic files to facilitate the generation of the Record Drawings.
- C. The Contractor shall modify the title block on each/every sheet to include only the project name, project address, Owner name, consultants' name and address, date, and clearly identify the set as "Record Drawings".
- D. All record drawings shall be provided in AutoCAD, Revit, and PDF formats. AutoCAD files shall be provided in "E-Transmit" format with all associated external references, image files, plot styles, and blocks included. CAD files shall be provided and labeled by sheet number. External references shall be setup up with relative file paths and not full (absolute) file paths. PDF files that are provided shall be one complete pdf file with the complete set of drawing files. The PDF shall be bookmarked by sheet number. Specifications shall be submitted in the same manner where they are complete pdf files by volume and bookmarked by specification section. In addition to the complete drawing set PDF, a separate file folder shall be provided with each sheet in the set saved as a separate file with the file named by sheet number. Create sub folders by discipline for all the individual sheet files.
- E. All modifications, additions, deletions, and revisions made to the project during the construction phase shall be reflected on the Record Drawings; and shall include, but not necessarily limited to:
 1. All as-built dimensions (different than original dimensions)
 2. All as-built locations and conditions relative to underground plumbing, sanitary and storm piping installations, natural gas piping and electrical conduits; shown accurately to within twelve (12) inches. Notes shall indicate approximate depth of all underground piping and utilities.
 3. All as-built conditions relative to ductwork installations; shown accurately to within six (6) inches.

4. All as-built conditions relative to HVAC water piping installations; shown accurately to within six (6) inches.
 5. All as-built conditions relative to underground electrical conduit installations. shown accurately to within six (6) inches.
 6. Record drawings shall include a copy of fire sprinkler layout of piping and equipment.
 7. All approved CPR's resulting in a physical change in the work.
 8. All RFI's resulting in a physical change in the work.
 9. All AEA's resulting in a physical change in the work.
 10. All Minor Changes resulting in a physical change in the work.
 11. All Construction Change Directives resulting in a physical change in the work.
 12. Update the list of drawings as necessary to reflect added and deleted sheets.
- F. All modifications shall be represented by actually deleting the original work and accurately depicting the revised as-built modifications/configurations. "X-ing out" deleted work shall not be accepted.
- G. Upon completion of all revisions to the Record Drawings, including the Architect's acceptance, the Record Drawings shall be copied to a thumb drive or solid-state media drive maintaining the exact folder/file structure originally furnished to the Contractor. Submit to the Architect for review before proceeding with deliverables.
- H. Deliverables: Upon Deliverables: review and acceptance of the documentation, including format, the Architect shall direct the Contractor to proceed with delivery of the following:
1. Three (3) thumb drives or solid-state media drives, containing the entire set of Record Drawings in PDF and TIFF format. Each sheet shall be a separate PDF and TIFF file. The thumb drives shall be organized to duplicate the order of drawings as they were issued for bidding and construction, with record drawing modifications.

4.5 RECORD SUBMITTALS

- A. The Contractor shall maintain and submit a separate set of final submittals to be delivered to the Owner as a condition of Contract Close-Out.
- B. Include only the final version of each submittal, including all submittal review comment sheets from the Architect and Consultant. Versions of submittals that were rejected or required to be revised and resubmitted are not required.
- C. Deliverables:
1. Deliver one (1) hard copy set of Record Submittals in file boxes, organized in order by specification division, with tabs included for each section of specifications and submittal log of contents of each file box.
 2. Deliver three (3) copies of all Record Submittals in PDF electronic format on three (3) thumb drives or solid-state media drives.

4.6 RECORD SPECIFICATIONS/PROJECT MANUAL

- A. The Contractor shall submit a record copy of specifications in PDF format on thumb drive or solid-state media drive. The PDF shall be formatted as stated in section 4.4, subsection D of this specification document. Record specifications shall be edited to contain only actual manufacturers, products, colors and model numbers actually used in the project.

4.7 CONTRACT CLOSE-OUT SCHEDULE

- A. If the Contractor fails to complete requirements of Contract Close-Out within sixty (60) days after the actual Substantial Completion date, Contractor shall be required to attend weekly meetings at the project site or Owner's office until such time as 100% of the Close-Out documents are

completed and accepted by the Owner. During this time the Contractor will be charged for the Owner's, Architect's and any A/E Consultant's time associated with achieving Final Completion.

1. Billable time shall include, without limitation, travel time, meeting time, document preparation, document review, and re-inspection of on-site conditions.
 2. The weekly meetings shall include a minimum of two (2) hours charge per participant.
 3. Refer to A201 – for Owner and Architect/A&E/Consultants billable times.
- B. In scheduling submission(s) and final approvals of Close-Out documents, the Contractor shall allow for the following review period for each submission:
1. Architect: Ten (10) calendar days
 2. Architect's Consultant: Twelve (12) calendar days.
- C. Additionally, failure by the Contractor to complete Contract Close-Out within the stipulated time will be reported to the Contractor's surety. In the report of deficiency, the Contractor and surety will be informed that, should correction work remain incomplete for fifteen (15) additional days, the Owner at his discretion may initiate action to complete corrective work out of the remaining contract funds in accordance with the Owner-Contractor Agreement, General and Supplementary Conditions to the Agreement as they apply.
1. Additional costs of the Owner, Architect, and other consultants incurred because of the Contractor's failure to complete Contract Close-Out within sixty (60) days after the date of Substantial Completion, unless extended by mutual agreement or provision of the contract, will be deducted from the funds remaining to be paid to the Contractor.

4.8 WARRANTY INSPECTION

Refer to: This summary is in accordance with AIA Document A201 § 3.5 - Warranty.

- A. Warranty periods start from Substantial Completion. If repairs are done post-Substantial Completion, warranty periods extend accordingly. The Contractor must track all warranty work and ensure its completion.
- B. Scheduled Inspections:
1. Approximately six months after Substantial Completion, and one month before the expiration of the one-year warranty, the Contractor shall notify the Architect and Owner to schedule a warranty inspection. A minimum of 10 days' notice must be provided to both the Architect and Owner prior to the inspection.
 2. At the scheduled inspections (6 and 11 months after Substantial Completion), the Contractor will inspect the project with the Owner and Architect and correct any deficiencies.
- C. Corrective Action:
1. For any defective work identified, the Contractor must immediately provide the necessary materials and labor to remedy the issues and continue working until the corrections are completed to the satisfaction of the Architect and Owner, even if the corrective work extends beyond the expiration of the warranty period.
 2. The Contractor is not responsible for correcting work that has been damaged by Owner neglect or abuse, or for replacing parts due to normal wear and tear.
- D. Warranty work must be completed within 10 working days unless specified otherwise. For urgent issues (e.g., life safety, HVAC, security), response times range from 4 to 6 hours.

- E. For urgent warranty requests, the Contractor must maintain an answering service available 24/7, 365 days a year.
- F. If the Contractor fails to complete warranty work within the specified timeframe, the Owner can complete the work and backcharge the Contractor for all related costs.

END OF SECTION

SECTION 01 91 00

GENERAL COMMISSIONING REQUIREMENTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Specifications throughout all Divisions of the Project Manual, which pertain to operable and non-operable equipment and/or building systems, are directly applicable to this Section, and this Section is directly applicable to them.

1.2 SUMMARY

- A. This Section establishes general and administrative requirements pertaining to commissioning of equipment, devices, and building systems on the project. Technical requirements for commissioning of particular systems and components are established in the respective technical sections of this Project Manual.
- B. It is of primary concern that all operable systems installed in the Project perform in accordance with the Contract Documents, the Owner's Project Requirements (OPR) and the Basis of Design (BOD). During Commissioning, the Contractor systematically demonstrates to the Owner or Owner's representative that the operable systems have been installed and performing in strict accordance with the Contract Documents.
- C. Commissioning requires cooperation and involvement of all parties throughout the construction process. The Contractor shall deliver a successful Commissioning process. Successful Commissioning requires that installation of all building systems complies with Contract Document requirements and that full operational check-out and necessary adjustments are performed prior to Substantial Completion with the exception of Deferred tests approved in advance by the Owner.
- D. Commissioning will encompass and coordinate traditionally separate functions of system documentation, installation checkout, System Verification Checklists and start-up, control system calibration and point-to-point checkout, testing, adjusting, and balancing, Functional Performance Tests, Integrated System Tests, Contractor demonstration to the Owner, and training of Owner's personnel. This requires assembling all related documentation into one cohesive collection. Commissioning is intended to achieve the following specific objectives of the Contract Documents:
- E. Verify and document proper installation and intended performance of equipment, systems, and integrated systems.
- F. Ensure that operating and maintenance and Commissioning documentation requirements are complete.
- G. Provide the Owner with functional buildings and systems that meet the Contract Document requirements and the Owner's Project Requirements (OPR) at Substantial Completion.

1.3 DEFINITIONS

- A. Basis of Design (BOD): A document that records the concepts, calculations, decisions, and product selections used to meet the Owner's Project Requirements and to satisfy applicable regulatory requirements, standards and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.
- B. Commissioning (Cx): A systematic process confirming that building systems have been installed, properly started, and consistently operated in strict accordance with the Project Documents, that all systems are complete and functioning in accordance with the Contract Documents at Substantial Completion, and the Contractor has provided the Owner adequate system documentation and training.

- C. Commissioning Authority (CxA): Party having a contractual agreement with the Owner to provide third party commissioning services as defined herein under Commissioning Authority's Role and Responsibilities. Commissioning Authority may represent the Owner and is authorized to act on behalf of the Owner. The Commissioning Authority does not have authority to alter design or installation procedures without the written approval of the Owner or the design team.
- D. Contract Documents: The General Conditions, Drawings, Specifications, Addenda, and other documents developed by the A/E Team and approved by the Owner that constitute the contractual obligations of the project scope.
- E. Control Point and Sensor Calibration Verification: Process of verifying the point integrity and/or sensor calibration from the physical point of monitoring (sensor, contact, actuator, etc.) to the digital point location at the Operator's interface within the respective control system (Building Automation, Lighting Controls, Power Status and Monitoring, etc.).
- F. Deferred Testing: Functional Performance or Integrated System Tests performed after Substantial Completion due to partial occupancy, partial equipment acceptance, seasonal requirements, design, or other site conditions that prohibit the test from being performed prior to Substantial Completion.
- G. Deficiency: Condition of a component, piece of equipment, or system that is not in compliance with the Project Documents.
- H. Functional Performance Test (FPT): Test of dynamic function and operation of equipment and systems executed by the Contractor and witnessed by the CxA. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, life safety conditions, power failure, etc. Systems are operated through all specified sequences of operation. Components are verified to be responding in accordance with requirements in the Project Documents.
- I. Functional Performance Testing Procedures: Commissioning protocols, detailed test procedures and instructions in tabular and script-type format that fully describe system configuration and steps required to determine if the system is performing and functioning properly.
- J. Integrated Systems Test (IST): Test of dynamic function and operation of multiple systems. Integrated Systems Tests are tested under various modes, such as fire alarm and emergency situations, life safety conditions, power failure, etc. Systems are integrally operated through all specified sequences of operation. Systems and interconnections are verified to be responding in accordance with the requirements in the Project Documents.
- K. Integrated Systems Testing Procedures: Commissioning protocols and detailed test procedures and instructions in tabular and script-type format that fully describe system configurations and steps required to determine if the interacting systems are performing and functioning properly.
- L. Operational Testing: Activities and testing occurring after initial energizing and/or start-up of equipment that determine whether equipment is operating within the manufacturer's recommendations and the design requirements. These activities are intended to ensure that equipment and systems meet all warranty requirements and are ready for Functional Performance Testing. Common examples are Testing, Adjusting and Balancing of HVAC systems and initial load testing of electrical equipment.
- M. Owner's Project Requirements (OPR): A written document that details the functional requirements of a project and the expectations of how the facility will be used and operated. These include project goals, measurable performance criteria, cost considerations, benchmarks, success criteria and supporting information.
- N. Project Documents: Consists of the Contract Documents, Approved Submittals, Requests for Information (RFI), Vendor documentation, Operations and Maintenance (O&M) information and other

documentation that determines the requirements for acceptable installation and operation of the specific equipment and systems on the project.

- O. System Verification Checklist (SVC): A list of static inspections and material or component tests that verify proper installation of equipment (e.g., belt tension, oil levels, labels affixed, gages in place, sensors calibrated, etc.), start-up activities and documentation, as well as operational testing results. The checklists are meant to document all activities for an individual piece of equipment from procurement on the project through operational testing are performed in accordance with the requirements in the project documents.
- P. Start-up: The activities where equipment is initially energized, tested and operated. Start-up is completed prior to Operational Testing and Functional Performance Testing and is an integral item documented in the System Verification Checklist (SVC).
- Q. Training Plan: A detailed plan prepared by the Contractor and reviewed by the Owner and Commissioning Authority that outlines the training activities, instructors, time durations, and system requirements in accordance with the Contract Documents and Commissioning Plan.
- R. Trending: Data collection of monitored points using the Building Automation System, Lighting Controls System, Power Status and Monitoring System or independent data acquisition instrumentation.

1.4 COMMISSIONING TEAM

- A. Owner shall appoint the following Members:
 - 1) Owner's Project Manager and any other designated representatives of the Owner's staff.
 - 2) Commissioning Authority (CxA)
 - 3) Architect/Engineer (A/E)
 - 4) Test, Adjust and Balance Firm (TAB) – may be sub-contracted to the CxA
- B. Contractor shall appoint the following Members:
 - 1) Individuals, each having authority to act on behalf of the entity they represent, explicitly organized to implement the Commissioning process through coordinated actions. At a minimum, the Contractor shall designate a Commissioning Coordinator and each major sub-contractor (Mechanical, Electrical, Plumbing, Building Automation) shall have a dedicated representative.
 - 2) Vendor representatives (as needed) required for start-up, operational testing, Functional Performance Testing, Integrated Systems Testing, and Owner Training activities.
 - 3) Representatives of independent testing agencies (Test, Adjust and Balance, Electrical Testing Agency, etc.)

1.5 ROLES AND RESPONSIBILITIES

- A. Roles and responsibilities of Commissioning Team members related to the Commissioning Process are provided in this Section. The respective entities defined below shall fulfill the listed roles and responsibilities as contained herein. Specific technical roles and responsibilities are defined in other sections of the Project Specifications.
- B. Owner's Roles and Responsibilities:

- 1) Provide guidance in development of the Owner's Project Requirements (OPR).
 - 2) Review Technical Specifications containing Commissioning requirements.
 - 3) Approve the Commissioning Scope of Work and schedule of Commissioning activities.
 - 4) Assign Owner's representatives and schedule them to participate in Commissioning activities, including the following:
 - a. Commissioning Team meetings.
 - b. Review and approval of the Commissioning Plan, Training Plan, System Verification Checklist templates, Functional Performance Test Procedures, Integrated Systems Test Procedures, Deferred Testing Plans, Final Commissioning Process Report, Systems Manual, Measurement and Verification Plan and other Commissioning documents.
 - c. Attend Owner Training sessions in operation and maintenance of systems and equipment.
 - d. Observation of Contractor's demonstration of systems and equipment operation.
- C. Commissioning Authority's (CxA) Roles and Responsibilities:
- 1) Prepare the Commissioning Plan with the Owner's and Contractor's review and input.
 - 2) Periodically attend and/or review the proceedings of the regular Construction Meetings hosted by the Contractor to understand the progress of construction activities on the project.
 - 3) Conduct and document Commissioning Team meetings including the Commissioning Kickoff Meeting.
 - 4) Perform site visits as necessary to observe component and system installations prior to energizing or start-up of equipment and systems.
 - 5) Review and comment on product data and shop drawing submittals and coordination drawings applicable to systems being commissioned.
 - 6) Following submittal review and approvals by the A/E team, review the sequences of operation and coordinate with the Contractor and A/E Team in order to prepare the Functional Performance Test Procedures and Integrated Systems Test procedures. Submit to the Owner and Contractor for review and comment prior to facilitating FPTs and ISTs on the project.
 - 7) Upon written notice that equipment or systems are ready for initial energizing or start-up, review the progress of the System Verification Checklist(s) for the respective systems and components and ensure that all requirements have been completed by the Contractor to permit energizing or start-up in accordance with the project documents; CxA shall issue written notice to the Owner and Contractor that equipment is ready to energize or start-up. CxA will witness and ensure proper documentation is provided by the Contractor for major equipment energizing and start-ups as executed by the Contractor with appropriate notice as indicated herein.
 - 8) Witness, verify, and document results of Functional Performance Tests and Integrated Systems Tests.
 - 9) Coordinate resolution of deficiencies identified during site observations, equipment energizing or start-up, Functional Performance Testing, Integrated Systems Testing, Deferred Testing, and during the warranty period.

- 10) Review the Operating and Maintenance (O&M) documents to ensure that as-built information and correct data is included prior to the Owner Training sessions; review final O&M submittal to ensure compliance with the requirements in the project documents and provide written comments to the Owner.
- 11) Review the Contractor's Training Plan and individual training agendas for compliance with the requirements in the project documents. Recommend acceptance to the Owner prior to the Contractor scheduling training sessions with the Owner. Review the attendance and content of the training sessions to ensure the requirements of the project documents are completed. Conduct a survey of the Owner's personnel to evaluate the effectiveness of the Owner Training.
- 12) Compile the Final Commissioning Process Report and submit to the Owner for review and approval.

D. Architect/Engineer's (A/E) Roles and Responsibilities:

- 1) Specify control sequences of operation within the Contract Documents that comply with the OPR and BOD.
- 2) Incorporate Commissioning requirements into the Contract Documents if requested by the Owner.
- 3) Attend Commissioning Team meetings.
- 4) Review the Commissioning Plan, System Verification Checklist templates, Functional Performance Test Procedures, Integrated Systems Test Procedures, Deferred Testing Plans, and other Commissioning documents as required by the Owner or the Contract Documents.
- 5) Review Contractor's Training Plan and provide comments to the Owner.
- 6) Approve technical requirements for correction of Deficiencies identified during Commissioning, Deferred Tests, and during the warranty period.
- 7) Review Operating and Maintenance Manuals and provide comments to the Owner.

E. Contractor's Roles and Responsibilities:

- 1) Contractor shall review and provide comments on documents produced by the Commissioning Authority, and shall accept the Commissioning Plan, System Verification Checklists, Functional Performance Test Procedures, and Integrated System Test Procedures as approved by the Owner.
- 2) Provide an individual, subject to the Owner's approval, experienced in construction and Commissioning of building systems to organize, schedule, conduct, and document the Contractor's responsibilities in the Commissioning process. The Contractor shall assign this individual to act as the Contractor's Commissioning Coordinator. The Contractor's Commissioning Coordinator may have additional duties such as MEP Coordinator, but not as Project Manager or Superintendent. Submit qualifications demonstrating the Commissioning Coordinator's technical expertise and experience to the Owner for approval. In the event that Contractor chooses to subcontract its Commissioning obligations, then Contractor must submit the subcontractor's qualifications and personnel to Owner for Owner's approval.
- 3) Furnish and install systems that meet all requirements of the Contract Documents.
- 4) Ensure that Commissioning Process activities are incorporated into the Master Project Schedule. The Contractor shall coordinate with the CxA and the Owner to determine the required activities, durations and predecessors.
- 5) Submit inspection requests, start-up requests and all supporting documentation in accordance with

the Contract Documents, General Conditions, and Commissioning Plan.

- 6) Cooperate with Owner's representative(s), provide access to work and provide adequate labor, resources, and time for Commissioning.
- 7) Furnish copies of all shop drawings and submittals, manufacturers' literature, maintenance information, and any other information required for the Commissioning process. Contractor must submit to the Owner installation and checkout materials actually shipped inside equipment and actual field checkout sheet forms used by the factory or field technicians. This requirement does not supersede any additional requirements contained in the Contract Documents.
- 8) Schedule and conduct pre-installation meetings and pre-commissioning meetings with subcontractors and equipment suppliers related to Commissioning. Contractor must invite Architect/Engineer, Owner and CxA to attend the pre-installation meetings and pre-commissioning meetings.
- 9) Provide qualified personnel, including subcontractors as required, to fully perform the testing and operational demonstrations required by the Contract Documents and the Commissioning Plan, including any Deferred Testing or re-testing related to warranty work.
- 10) Correct deficiencies identified during any stage of the Commissioning process.
- 11) Coordinate with the CxA to develop the Training Plan and submit to the Owner for approval. Provide training to the Owner's personnel in accordance with the Contract Documents and the approved Training Plan. Coordinate with the Owner to schedule training sessions and coordinate subcontractor/vendor participation in all training sessions.
- 12) Perform Deferred Testing and make necessary amendments to Operating and Maintenance Manuals and as-built drawings for applicable issues identified during the Deferred Testing.
- 13) Perform system maintenance during construction as specified and recommended by the Owner and send the maintenance records to the Owner for Record.
- 14) Document the equipment as it arrives onsite to ensure that the submitted and received equipment is correct as it arrives onsite, including the completion of the system verification sections pertaining to the procurement process.

1.6. SYSTEMS TO BE COMMISSIONED

1.6.1. The following systems shall be commissioned according to the process defined in this Section:

1.6.1.1. Major HVAC Systems (100% including but not limited to the list below)

- 1.6.1.1.1 Air Handling Units
- 1.6.1.1.2 Fan Coil Units
- 1.6.1.1.3 Exhaust Fans
- 1.6.1.1.4 Supply Fans
- 1.6.1.1.5 Pumps
- 1.6.1.1.6 Chillers
- 1.6.1.1.7 Boilers

1.6.1.2. Terminal Units (10% Sampling)

1.6.1.3. Building Automation System

1.6.1.4. Lighting Controls - Occupancy Sensors (25% greater than 25 sensors installed, 100% less than 25 sensors installed)

- 1.6.1.5. Lighting - Daylight Controls (100%)
- 1.6.1.6. Lighting - Time Switch Controls (100%)
- 1.6.1.7. Normal and Emergency Power Systems

PART 2 - PRODUCTS

2.1. COMMISSIONING PLAN

- 2.1.1. Document developed by the CxA that provides the structure, schedule, and coordination plan for the Commissioning Process from the Pre-construction phase through the Occupancy Phase. The Commissioning Plan shall describe the project and systems to be commissioned, Commissioning Process activities and deliverables, procedures to follow throughout the process, specific roles and responsibilities for each participant, and general description of testing and verification methods.
- 2.1.2. The Commissioning Plan shall comply with the Owner's Project Requirements (OPR).
- 2.1.3. The Commissioning Team shall review the Commissioning Plan prior to the Pre-Commissioning Meeting and submit written comments or questions to the CxA to be addressed in the meeting.
- 2.1.4. Following the Pre-Commissioning meeting, the CxA shall incorporate all changes discussed and agreed upon in the Pre-Commissioning meeting and submit the Final Commissioning Plan to the Commissioning Team for approval and acceptance.
- 2.1.5. If changes to the Commissioning Plan are needed during the Commissioning Process, the CxA shall edit the plan and distribute to the Commissioning Team for approval and acceptance.
- 2.1.6. The Contractor's acceptance shall constitute acceptance of all parties sub-contracted to the Contractor. The Contractor shall ensure that all sub-contractors and vendors agree and accept the Commissioning Plan.

2.2. SYSTEM VERIFICATION CHECKLISTS

- 2.2.1. System Verification Checklists (SVCs) are important to ensure that the equipment and systems are connected and operational and that Functional Performance Testing proceeds without unnecessary delays. These checklists document the inspections and procedures necessary to take a piece of equipment from a static state into an operating state. These checklists augment the manufacturer's start-up checklists to provide a complete document from procurement to the start of Functional Performance Testing when combined.
- 2.2.2. The CxA shall develop the System Verification Checklist templates for review by the Cx Team. The Contractor, appropriate Subcontractors and Vendors shall support the CxA in development of SVCs for each system and components by providing any necessary supporting documentation as requested by the CxA and reviewing and commenting on the checklist templates in accordance with the Project Specifications and the Commissioning Plan.
- 2.2.3. Once the checklist templates are reviewed and accepted, the CxA will produce checklists for all equipment and components to be commissioned on the project utilizing an electronic commissioning database that is accessible via web portal or local field tool (i.e., iPad, tablet, laptop, etc.).
- 2.2.4. The CxA shall provide login access and training to the Contractor and other members of the Cx Team in the use of the electronic commissioning database.
- 2.2.5. The Contractor shall be responsible for completing the required sections of the System Verification

Checklists utilizing the electronic commissioning database and providing all supporting documentation via electronic transmittal to the CxA. Additional requirements for completion of the SVCs are included in this section and other technical sections of the Specifications.

- 2.2.6. Once equipment arrives on the project site, the Contractor or sub-contractors shall begin completing the individual checklists and continue throughout the installation process. The checklists are meant to be progressive and a tool for tracking progress.
- 2.2.7. Once the SVCs are electronically completed, the CxA will review and approve the checklists and supporting documentation and compile the information to include in the Final Commissioning Process Report.

2.3. FUNCTIONAL PERFORMANCE TESTING PROCEDURES:

- 2.3.1. The purpose of the Functional Performance Testing Procedures is to verify and document that the equipment and systems on the project individually perform in accordance with the requirements in the Contract Documents and meet the Owner's Project Requirements.
- 2.3.2. The CxA shall develop specific script-type test procedures to verify and document proper operation of each piece of equipment and system. The Contractor shall provide any supporting information to the CxA that may be needed including but not limited to product submittals, O&M information, and sequences of operation. Once developed, the CxA will issue to the Cx Team for review and comment.
- 2.3.3. The Commissioning Team shall review the Functional Performance Test procedures and submit written comments or questions to the CxA. The Contractor shall ensure that the sub-contractors and any vendors that would be involved with Functional Performance Testing review the procedures and provide comments.
- 2.3.4. The CxA will coordinate with the Cx Team to address any comments and produce the final FPT procedures for acceptance by the Cx Team. The Contractor's acceptance shall constitute acceptance of all parties sub-contracted to the Contractor.
- 2.3.5. The Contractor shall utilize the FPT procedures for any pre-testing activities prior to Functional Performance Testing.

2.4. INTEGRATED SYSTEMS TESTING PROCEDURES:

- 2.4.1. The purpose of the Integrated Systems Testing Procedures is to verify and document that all the integrated equipment and systems on the project perform together in accordance with the requirements in the Contract Documents and meet the Owner's Project Requirements.
- 2.4.2. The CxA shall develop specific script-type test procedures to verify and document proper operation of the integrated systems throughout the facility. The Contractor shall provide any supporting information to the CxA that may be needed including but not limited to product submittals, O&M information, and sequences of operation. Once developed, the CxA will issue to the Cx Team for review and comment.
- 2.4.3. The Commissioning Team shall review the Integrated Systems Testing procedures and submit written comments or questions to the CxA. The Contractor shall ensure that the sub-contractors and any vendors that would be involved with Integrated Systems Testing review the procedures and provide comments.
- 2.4.4. The CxA shall coordinate with the Cx Team to address any comments and produce the final IST procedures for acceptance by the Cx Team. The Contractor's acceptance shall constitute acceptance of all parties sub-contracted to the Contractor.

- 2.4.5. The CxA shall also develop the IST personnel matrix that will be utilized to track the individual testing teams involved with the IST. The CxA will distribute the matrix to the Cx Team so that the Contractor and Owner can assign the appropriate personnel to the appropriate teams.
- 2.4.6. The CxA shall also host a coordination meeting prior to the IST to review the IST procedures, complete any final coordination, review safety procedures, and answer any questions.
- 2.4.7. The CxA estimates there will be two Integrated Systems Tests on the project. The first will test the Data Center systems separately and the second will test the entire facility. Requirements of the testing are included in the respective technical sections of the Project Specifications.
- 2.4.8. The IST procedures shall be utilized by the Contractor for any pre-testing activities prior to official Integrated Systems Testing.

2.5. TRAINING PLAN

- 2.5.1. Contractor, in coordination with Owner and CxA, shall develop the Training Plan with project specific requirements for Owner Training, after reviewing the different systems to be installed and commissioned. The purpose of the Training Plan is to specifically communicate the required content and training durations required by the Owner based upon the type of equipment and the Owner's past experience.
- 2.5.2. The Contractor shall review all of the individual technical sections of this specification for specific training requirements.
- 2.5.3. The Contractor shall coordinate with the Owner to ensure that the proposed training requirements meet the Owner's needs and expectations.
- 2.5.4. The Contractor shall coordinate with the sub-contractors and vendors to ensure the Owner Training requirements can be achieved and gather any additional information or recommendations.
- 2.5.5. Any changes to the training requirements in this specification must follow contractual protocols.
- 2.5.6. The Training Plan shall include a list of systems and equipment for which training will be provided according to the three-tiered training approach outlined in the project specifications.
- 2.5.7. All training sessions shall have a syllabus indicating the following as a minimum in addition to any other specification requirements:
 - 2.5.7.1. Session Objectives
 - 2.5.7.2. Proposed Instructor(s)
 - 2.5.7.3. Instructor Qualifications
 - 2.5.7.4. Training Materials that will be provided
 - 2.5.7.5. Location and durations of the various parts of the training session (i.e., Classroom, On-site, etc.)
 - 2.5.7.6. Applicable specification sections and O&M Manual sections
 - 2.5.7.7. Detailed outline of training session content
- 2.5.8. The Contractor shall coordinate with the CxA to organize the systemic training sessions comparable

to the organization of the Systems Manual.

- 2.5.9. Owner training must be completed prior to the contractor obtaining substantial completion by the Owner.

2.6. FINAL COMMISSIONING PROCESS REPORT

- 2.6.1. The CxA shall prepare the Final Commissioning Process Report that will include the following:

- 2.6.1.1. Executive Summary
- 2.6.1.2. Participants and Roles
- 2.6.1.3. Brief building description
- 2.6.1.4. Overview of commissioning and testing scope
- 2.6.1.5. General description of testing and verification methods
- 2.6.1.6. Appendices with supporting information, issues log, and communications

- 2.6.2. The Contractor shall coordinate with the CxA to provide any additional information that may be needed to complete the Final Commissioning Process Report.

- 2.6.3. The Contractor shall resolve any outstanding commissioning items prior to the CxA preparing the final commissioning report.

- 2.6.4. The CxA shall issue the Final Commissioning Process Report to the Cx Team for review. The Owner shall approve the Final Commissioning Process report after any comments or discrepancies are resolved by the CxA.

PART 3- EXECUTION

3.1. PROJECT SCHEDULE

- 3.1.1. The Contractor shall integrate all Commissioning activities into the detailed Project Schedule. All parties will address scheduling problems and make necessary notifications in a timely manner to expedite the Commissioning Process.

3.2. COMMISSIONING TEAM MEETINGS

- 3.2.1. Upon obtaining Owner's approval of the Commissioning Plan, the CxA shall coordinate with the Cx Team to schedule, plan, and conduct a Pre-Commissioning Meeting with all parties involved in the Commissioning process. This meeting should include the major subcontractors, specialty manufacturers/suppliers, Architect/Engineer, Test, Adjust, and Balance (TAB) Firm, Electrical Testing Agency, and Owner's representatives as participants.

- 3.2.2. Contractor shall prepare for the Pre-Commissioning Meeting by supplying the following documents created by the CxA to all applicable sub-contractors and vendors: Commissioning Plan, Example System Verification Checklists, Example Functional Performance Test Procedures and Example Integrated Systems Test Procedures.

- 3.2.3. The CxA shall conduct the Pre-Commissioning Meeting and review all aspects of the Commissioning Plan and applicable specifications.

- 3.2.4. The Commissioning Plan shall be reviewed with all attendees and the scope of work discussed. Contractor should be prepared to distribute copies of the pertinent sections to the various subcontractors involved in the Commissioning process.
- 3.2.5. The final outcome of the meeting shall be an understanding of the commissioning process, roles and responsibilities, and consensus acceptance of the Commissioning Plan by the Cx Team.
- 3.2.6. The Contractor may request additional meetings with the CxA and individual sub-contractors to clarify roles, responsibilities and procedures as needed.

3.3. TEST EQUIPMENT

- 3.3.1. Contractor shall provide all specialized tools, test equipment and instruments required to execute start-up, checkout, and testing of equipment.
- 3.3.2. All specialized tools, test equipment and instruments required to execute start-up, checkout, and testing of equipment shall be of sufficient quality and accuracy to test and/or measure system performance within specified tolerances. A testing laboratory must have calibrated test equipment within the previous twelve (12) months. Calibration shall be NIST traceable. Contractor must calibrate test equipment and instruments according to manufacturer's recommended intervals and whenever the test equipment is dropped or damaged. Calibration tags must be affixed to the test equipment or certificates readily available.

3.4. REPORTING

- 3.4.1. Beginning at the procurement stage for the equipment included in the Cx scope, the Contractor shall communicate at least monthly with all members of the Commissioning Team, keeping them apprised of construction progress and scheduling changes.
- 3.4.2. Contractor shall submit Deficiency reports to the Owner within five (5) days of the deficiency occurrence. This includes responses to items noted by the Commissioning Authority.

3.5. DEFICIENCY RESOLUTION

- 3.5.1. The CxA shall document any issues noted during observation or testing activities in the Commissioning Issues Log (CxIL). The CxIL shall be distributed electronically to the Cx Team at regular intervals.
- 3.5.2. The Contractor shall respond in writing to the CxA within 10 days to all new CxIL items regardless of the disposition. This response does not constitute a request for re-verification, only an acknowledgement of the outstanding item. The Contractor should utilize CxIL responses to update the Cx Team on the progress of deficiency resolution.
- 3.5.3. The Contractor shall respond to the CxA and the Owner indicating CxIL items that are completed and ready for the CxA to verify completion.
- 3.5.4. If any item indicated complete by the Contractor is found to be incomplete by the CxA upon re-verification the Contractor is responsible for all costs and additional compensation resulting from incomplete Cx Issues Log items.

3.6. REQUEST FOR ENERGIZING / START-UP OF EQUIPMENT

- 3.6.1. The Owner and/or Owner's representative may install lockout devices on equipment in addition to the Contractor's lockout / tagout devices once permanent power is connected to the facility. This lock would be removed once the proper start-up notification is received by the Owner and/or CxA, and the CxA has reviewed the appropriate SVCs and supporting documentation to verify the

equipment is ready for energizing and/or start-up.

- 3.6.2. These requirements do not supersede any additional requirements noted elsewhere in the Contract Documents or as required by applicable code authorities.
 - 3.6.3. Contractor shall notify Owner and CxA in writing to request initial energizing and/or start-up of equipment and systems at least 72 hours (not including weekends or holidays) prior to the scheduled start-up.
 - 3.6.4. Contractor shall complete the applicable sections of the System Verification Checklist(s) evidencing the Contractor's thorough inspection of the system and readiness for start-up activities as required by the Project Documents and the Commissioning Plan. Contractor shall submit required supporting documentation to the Owner and/or CxA, including but not limited to, factory testing reports, alignment reports, electrical testing reports and any other documentation required by the Project Documents prior to energizing and/or start-up.
 - 3.6.5. The CxA shall review the SVCs and supporting documentation within the 72-hour notice period and confirm in writing that the systems and equipment are approved to proceed with energizing and start-up.
 - 3.6.6. The CxA and/or owner may witness equipment energizing and/or start-up at the scheduled time, but witness is not required, unless noted elsewhere in the Specifications, as long as written approval is received as noted herein.
 - 3.6.7. Contractor shall perform Start-up under supervision of the responsible manufacturer's representative in accordance with manufacturer's instructions and Project Document requirements.
 - 3.6.8. Contractor shall complete all required factory start-up documentation and applicable items in the System Verification Checklists, prior to startup, to ensure compliance with the requirements in the Project Documents.
- 3.7. OPERATIONAL TESTING
- 3.7.1. Once the appropriate start-up activities are completed, the Contractor shall complete all necessary operational testing requirements included in the Project Documents prior to Functional Performance Testing. Specific requirements for systems and equipment are included in other technical sections of the Specifications.
 - 3.7.2. Contractor shall complete all operational testing items in the System Verification Checklist and submit all supporting documentation to the Owner and/or CxA for review.
 - 3.7.3. Contractor and manufacturer's representatives shall supervise and coordinate adjustments and balancing of all devices and systems for proper operation prior to requesting a Functional Performance Test(s).
 - 3.7.4. Contractor shall clearly list outstanding items or System Verification Checklist items not completed successfully. Contractor shall obtain from Subcontractor or vendor completed forms documenting any outstanding deficiencies within five (5) days of completion of energizing and/or start-up activities.
 - 3.7.5. Contractor shall review completed deficiencies to determine if outstanding items prevent execution of the Functional Performance Tests and shall issue any necessary responses to the Owner and/or Commissioning Authority.
 - 3.7.6. Contractor shall notify Owner and CxA in writing to request Functional Performance Testing of equipment and systems at least 72 hours (not including weekends or holidays) prior to the scheduled

activities. Owner may require Contractor to reschedule Functional Performance Testing to ensure availability of Owner's representative(s) as needed.

- 3.7.7. The CxA shall review the SVCs and supporting documentation within the 72-hour notice period and confirm in writing that the systems and equipment are approved to proceed with Functional Performance Testing.
- 3.7.8. If any item indicated complete by the Contractor is found to be incomplete by the CxA upon re-verification the Contractor is responsible for all costs and additional compensation resulting from incomplete System Verification Checklist items.

3.8. CONTROL POINT AND SENSOR CALIBRATION VERIFICATION

- 3.8.1. Automation systems installed on the project must be fully verified for point integrity and sensor calibration prior to Functional Performance Testing. Additional requirements for this verification are listed in other technical sections of the Specifications.
- 3.8.2. The Contractor shall verify these points according to the requirements in the project documents as part of start-up and operational testing of systems.
- 3.8.3. The TAB contractor shall independently verify each sensor and point and document the results to be included in the Final TAB Report.
- 3.8.4. The CxA will witness, at their discretion, this verification and/or independently verify and document the results to be included in the Final Commissioning Process Report.
- 3.8.5. These activities must be completed prior to the Contractor requesting Functional Performance Testing as indicated herein.

3.9. FUNCTIONAL PERFORMANCE TESTING

- 3.9.1. The objective of Functional Performance Testing is to demonstrate that each system operates according to the requirements in the Project Documents and meets the OPR and BOD.
- 3.9.2. Contractor shall operate, or cause to be operated, each system, device, or equipment item, both intermittently and continuously, for a duration period as indicated in the Specification Section(s) for each item and/or in accordance with the Project Documents, the Commissioning Plan and applicable Functional Performance Testing procedures.
- 3.9.3. Contractor shall operate each component device and each building system to the full extent of its capability, from minimum to maximum, and under automatic control and manual control.
- 3.9.4. The CxA and members of the Cx Team, including the Owner's personnel, may observe Functional Performance Testing of equipment components and systems. The CxA shall facilitate the Functional Performance Testing activities according to the accepted FPT procedures and record the results of all testing activities.
- 3.9.5. The CxA shall record any deficiencies noted during the testing in the CxIL. If significant deficiencies exist, the owner and/or CxA may request that the testing activities be terminated and re-scheduled after proper verification by the Contractor. The Contractor is responsible for all costs and additional compensation resulting from deficiencies and incomplete systems noted during scheduled Functional Performance Testing.
- 3.9.6. All Functional Performance Testing of Integrated Systems must be completed in accordance with the Project Documents and the Commissioning Plan prior to the Contractor scheduling the Integrated Systems Testing activities.

3.10. INTEGRATED SYSTEMS TESTING

- 3.10.1. The objective of Integrated Systems Testing is to demonstrate that each integrated system operates jointly and/or independently of other systems according to the requirements in the Contract Documents.
- 3.10.2. Contractor shall operate each system, jointly and independently of other systems, through selected modes of operation (fire alarm integration with HVAC, emergency power modes, equipment failures among related systems, etc.) according to the accepted Integrated Systems Testing procedures developed by the CxA. The CxA shall facilitate and document the testing, organizing the appropriate testing teams and providing sufficient instruction to all participants to conduct efficient and effective testing activities.
- 3.10.3. Integrated Systems Testing typically involves multiple teams with representation from the CxA, Owner, and Contractor. The Contractor shall provide any needed communication equipment (i.e., radios) or make available any centralized intercom or paging system for communication with all testing groups.
- 3.10.4. The Contractor shall provide no less than 7 days (not including weekends or holidays) notice when requesting to conduct the Integrated Systems Testing. All personnel must be assigned to the Personnel Matrix by the CxA and a coordination meeting held within the 7 day period as prescribed elsewhere in this section.
- 3.10.5. Contractor conducts Integrated Systems Testing after all applicable Functional Performance Testing is satisfactorily completed and approved by the Owner and/or CxA.
- 3.10.6. The CxA shall record any deficiencies noted during the testing in the CxIL. If significant deficiencies exist, the owner and/or CxA may request that the testing activities be terminated and re-scheduled after proper verification by the Contractor. The Contractor is responsible for all costs and additional compensation resulting from deficiencies and incomplete systems noted during scheduled Integrated Systems Testing.

3.11. DEMONSTRATION AND OWNER TRAINING

- 3.11.1. The Contractor, in coordination with Owner and CxA, shall develop the Training Plan with project specific requirements for Owner Training as required throughout various sections of the Project Specifications.
- 3.11.2. The specific requirements for scheduling and conducting the Owner Training are included in other sections of this Specification.
- 3.11.3. Owner Training activities shall not occur until the Training Plan is approved by the Owner and the Contractor has submitted all O&M information for review and use during the training sessions.
- 3.11.4. The Contractor shall notify the CxA of all training sessions. The Contractor shall record attendance of the training sessions and the Owner shall ensure the appropriate personnel are in attendance.
- 3.11.5. The CxA shall ensure the content of the Owner Training sessions meets the requirements in the Project Documents.
- 3.11.6. The CxA may conduct surveys of the Owner's personnel to gauge the effectiveness of the Owner training sessions. If unfavorable surveys are received by the Owner's personnel indicating unsatisfactory training, the Owner reserves the right to require the Contractor to re-train in those specific areas of non-conformance until the requirements in the Project Documents are satisfactorily completed.

- 3.11.7. Owner training must be completed prior to the contractor obtaining substantial completion by the Owner.
- 3.12. DEFERRED / SEASONAL TESTING
 - 3.12.1. All Construction phase requirements of the Commissioning Process must be completed prior to Substantial Completion or as indicated elsewhere in this Specification.
 - 3.12.2. If any testing or other requirements cannot be completed prior to Substantial Completion due to the building structure, required occupancy condition, or other condition, performance of such test may be delayed to later in the warranty period, upon approval of the Owner. Contractor shall reschedule testing according to the protocols described in this section and any other operational protocols prescribed by the Owner.
 - 3.12.3. Contractor shall complete all outstanding commissioning requirements as part of this Contract during the warranty period. Contractor shall schedule all activities with Owner and/or CxA.
 - 3.12.4. The CxA shall document any deferred testing activities and ensure the appropriate commissioning documents are updated. The Contractor shall provide any additional documentation needed by the CxA to complete these requirements.

END OF SECTION

SECTION 02 1100
SITE CLEARING

PART 1 - GENERAL

- 1.1 Description
- A. Work under this Section of the Specifications includes general site clearing operations, including trees and vegetation removal, protection of existing trees to be left standing, and clearing and grubbing.
- 1.2 Provide barricades, coverings, or other types of protection necessary to prevent damage to existing improvements not indicated to be removed, and improvements on adjoining properties.
- A. Restore all improvements damaged by this Work to their original condition, and acceptable to the Owner, the County, and other parties or authorities having jurisdiction.
- 1.3 Protect existing trees and other vegetation indicated to remain in place against cutting, breaking, or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary fences, barricades or guards as required to protect trees and vegetation to be left standing.
- 1.4 Burning where allowed by local ordinances will be permitted.

PART 2 - PRODUCTS

- 2.1 Not Applicable.

PART 3 - EXECUTION

- 3.1 Clearing
- A. Remove from the site trees, brush, shrubs, down timber, rotten wood, rubbish, other vegetation as well as fences, and incidental structures necessary to allow for new construction.
- (1) Remove all trees, stumps and roots within 10' of any structure or pipeline.
- (2) Stumps of trees, other than the above, to be left in place shall be cut off shall be left not more than 6" above original grade. Remove all stumps unless in a fill section greater than 5 feet.

- B. Clearing work shall be restricted to area within rights-of-way or easements or within "Construction Limits" indicated on Contract Drawings.

3.2 Existing Trees and Shrubs

- A. Trees and shrubs that are to remain within "Construction Limits" will be indicated on Contract Drawings or conspicuously marked on site.
- B. Ownership to Trees: Unless otherwise noted, trees within the "Construction Limits" shall become the property of the Contractor and shall be removed from the site.

3.3 Grubbing

- A. Grub areas within and to a point 10' outside of all structures and pipe lines, areas to receive fill where finished grade will be less than 3' above existing grade, cut areas where finished grade will be less than 2' below existing grade, transitional areas between cut and fill, and any area to receive control fill.
- B. Remove from the ground to a depth of 18", all stumps, roots ½" and larger, organic material and debris.
- C. Use only hand methods for grubbing inside the drip lines of trees which are to remain.

3.4 Clean up debris resulting from site clearing operations continuously with the progress of the work.

3.5 Remove all waste material from site.

3.6 Remove debris from site in such a manner as to prevent spillage. Keep pavement and area adjacent to site clean and free from mud, dirt and debris at all times.

END OF SECTION

**SECTION 02 4100
SELECTIVE DEMOLITION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Selective demolition of building elements, furniture and equipment for alterations purposes.

1.02 RELATED REQUIREMENTS

- A. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- B. Section 01 6000 - Product Requirements: Handling and storage of items removed for salvage and relocation.
- C. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

1.03 REFERENCE STANDARDS

- A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction including deep foundation elements remaining.

1.05 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: Company specializing in the type of work required.
 - 1. Minimum of 5 years of documented experience.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 SCOPE

- A. Remove portions of existing walls as indicated on the drawings.
- B. Remove portions of existing ceilings as indicated on the drawings.
- C. Remove other items indicated, for salvage, relocation, and recycling.
- D. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as required so that required rough grade elevations do not subside within one year after completion.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with other requirements specified in Section 01 7000.
- B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Comply with applicable requirements of NFPA 241.
 - 3. Use of explosives is not permitted.
 - 4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 5. Provide, erect, and maintain temporary barriers and security devices.

6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
 7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 8. Do not close or obstruct roadways or sidewalks without permit.
 9. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
 10. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- C. Do not begin removal until receipt of notification to proceed from Owner.
- D. Prior to submitting proposal, Contractor shall request a list from the Owner stating items which shall be removed by the Owner prior to demolition.
- E. Included with the demolition proposal, Contractor shall provide a written declaration of items that will be salvaged from the site. Each item shall be itemized and a monetary value assigned. Credit value of salvaged items shall be included in calculation of proposal. Declaration shall be reviewed by the Owner to determine that the declaration complies with state requirements and local Board policy in regards to disposing of public property.
- F. All items called for on the drawings to be salvaged, removed and relocated shall be inventoried, removed and stored until such time as they are to be installed in their new location. The inventory list shall be given to the Owner and shall include an itemized list that includes quantities, descriptions and condition of each item. These items are considered to be in good operating condition at the time the contract is signed, and shall remain the property of Owner. These items shall be properly protected by the contractor and removed by him, complete, including all appurtenances and reinstalled in their new location in good working order with any modifications called for by the drawings.
- G. All items noted on the drawings to be removed and delivered to the Owner shall be cataloged with a written description and delivered to Owner at a location designated by the Owner.
- H. Do not begin removal until built elements to be salvaged or relocated have been removed.
- I. Do not begin removal until vegetation to be relocated has been removed and specified measures have been taken to protect vegetation to remain.
- J. Protect existing structures and other elements that are not to be removed.
1. Provide bracing and shoring.
 2. Prevent movement or settlement of adjacent structures.
 3. Stop work immediately if adjacent structures appear to be in danger.
- K. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- L. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.
- M. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

3.03 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Drawings showing existing construction and utilities are based on existing record documents and field observation.
1. Verify that construction, salvage items and utility arrangements are as shown.
 2. Report discrepancies to Architect before disturbing existing installation.
 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

- B. Separate areas in which demolition is being conducted from other areas that are still occupied.
 - 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 in locations indicated on drawings.
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
- D. Remove existing work as indicated and as required to accomplish new work.
- E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
 - 2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - 3. Verify that abandoned services serve only abandoned facilities before removal.
 - 4. Remove abandoned pipe, ducts, conduits, and equipment as indicated on the drawings; remove back to source of supply where possible, otherwise cap stub and tag with identification.
- F. Protect existing work to remain.
 - 1. Prevent movement of structure; provide shoring and bracing if necessary.
 - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 - 3. Repair adjacent construction and finishes damaged during removal work.
 - 4. Patch as specified for patching new work.

3.04 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Remove from site all materials not to be reused on site; do not burn or bury.
- C. Leave site in clean condition, ready for subsequent work.
- D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

**SECTION 02 4117
DEMOLITION**

PART 1 – GENERAL

1.01 DESCRIPTION

- A. This Section specifies the requirements for demolition of facilities and structures.
- B. Extent of demolition work is shown on Drawings. Demolition may, but not necessarily, require removal and disposal, off the Work Site, of the following:
 - 1. Building structures, as indicated on Drawings, except items to be removed by COM prior to start of work.
 - 2. Entrances, drives, parking lots and structures, and adjacent landscape work to limits indicated on Drawings.
 - 3. Building foundations and supporting walls to a uniform depth of 12 inches below lowest foundation elevation.
 - 4. Paving, curbs, gutters, walkways, and related concrete and asphalt.

1.02 SUBMITTALS

- A. In accordance with Section 01340 - Shop Drawings, Product Data, Samples, and Record Documents of these Specifications, the following shall be submitted:
 - 1. Proposed methods and operations of building demo to UH for review and approval prior to start of Work. Include required coordination by agencies for shut-off, capping, and continuation of utility services as required. Provide a detailed sequence of demolition and removal work to ensure uninterrupted progress of COM operations.

1.03 QUALITY ASSURANCE/JOB CONDITIONS

- A. Reference Standards Applicable to this Section
 - 1. ANSI: American National Standards Institute
 - a. A10.6 Safety Requirements for Demolition Operations
 - 2. NFPA: National Fire Protection Association.
 - a. 30: Flammable and Combustible Liquids Code
 - b. 241: Standard for Safeguarding Building Construction and Demolition Operations.
- B. Regulations
Comply with applicable OSHA and EPA regulations and codes and local ordinances.
- C. Occupancy

Structures to be demolished will be discontinued in use prior to start of Work.

D. Condition of Structures and Work Site

HCCS assumes no responsibility for actual condition of structures to be demolished. Conditions existing at time of inspection for bidding purposes will be maintained by COM insofar as practicable. However, variations within structure and Work Site may occur prior to start of demolition work.

E. Partial Removal

Items of value to Contractor maybe removed, as directed, as Work progresses. Salvaged items shall become the property of the Contractor and shall be transported from Site as they are removed. Storage or sale of removed items on-Site will not be permitted.

F. Explosives

Use of explosives will not be permitted.

G. Traffic

Contractor shall comply with Section 01570 - Traffic Regulation of these Specifications. Conduct demolition operations and removal of debris to ensure minimum interference with COM operations, roads, streets, walks, and adjacent facilities. Do not close or obstruct streets, walks or other facilities without written permission from authorities having jurisdiction. Provide and identify alternate routes around closed or obstructed traffic ways as required by governing regulations.

H. Protection

Contractor shall comply with Section 01510 - Temporary Facilities of these Specifications. Ensure safe passage of persons around area of demolition. Conduct operations to prevent injury to persons and adjacent buildings, structures, and facilities. Erect temporary covered passageways as required by authorities having jurisdiction. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement or collapse of structures to be demolished and adjacent facilities to remain.

I. Damages

Promptly repair damages caused by demolition operations at no cost to COM or adjacent property owners.

J. Utility Services

Contractor shall comply with Section 01541 - Maintenance and Protection of Utilities of these Specifications. Maintain existing utilities indicated to remain, keep in like service, and protect against damage during demolition operations. Do not interrupt existing utilities serving facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary service during interruptions to existing utilities, as acceptable to governing authorities. Contractor shall disconnect and seal utilities serving structures to be demolished, prior to start of demolition work, upon written direction of COM and utility owner.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 DEMOLITION

A. General

Contractor shall comply with NFPA 241 and ANSI A 10.6 prior to and during commencement of demolition.

B. Pollution Control

Contractor shall comply with Section 01560 - Environmental Impact Controls of these Specifications. Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. Comply with governing EPA, OSHA, and local regulations pertaining to environmental protection. Do not create hazardous or objectionable conditions such as flooding and water pollution. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations, as directed by governing authorities. Return adjacent areas to condition existing prior to start of Work.

C. Building Demolition

Demolish building and structures completely and remove from Work Site. Use such methods as required to complete Work within limitations of governing regulations.

1. Proceed with demolition in systematic manner, from top of structure to ground.
2. Demolish concrete and masonry in small sections.
3. Break up and remove concrete and asphalt slabs-on-grade, unless otherwise shown to remain.

D. Below-Grade Construction

Demolish foundation walls to a depth of not less than 12 inches below subgrade or lowest foundation element. Demolish and remove below-grade wood, metal construction, floor construction, and concrete and asphalt slabs.

E. Filling Voids

1. Completely fill below-grade areas and voids resulting from demolition. Coordinate with work of Sections 02110 - Site Clearing, and 02200 - Earthwork of these Specifications.
2. Use satisfactory soil materials consisting of stone, gravel, and sand, free from debris, trash, frozen materials, roots and other organic matter.
3. Prior to placement of fill materials, ensure that areas to be filled are free of standing water, frost, frozen material, trash and debris.
4. Place fill materials in horizontal layers not exceeding 8 inches in loose depth. Compact each

5. layer at optimum moisture content of fill material to a density as specified in Section 02200 - Earthwork of these Specifications.

6. After fill placement and compaction as specified, grade surface to meet adjacent contours and to provide flow to surface drainage structures.

3.02 DISPOSAL OF DEMOLISHED MATERIALS

A. General

Remove from Work Site debris, rubbish, and other materials resulting from demolition operations. Burning of removed materials from demolished structures will not be permitted on Site.

B. Removal

Safely transport demolished materials and dispose of legally off Site. Contractor shall comply with NFPA 241, ANSI A 10.6, and NFPA 30, as applicable to the Work of disposal and transport.

END OF SECTION

**SECTION 03 0580
UNDER-SLAB VAPOR BARRIER - RETARDER**

PART 1 – GENERAL

1.1 SUMMARY

- A. Products supplied under this section:
 - 1. Vapor barrier and installation accessories for installation under concrete slabs.
- B. Related sections:
 - 1. Section 03 3000 Cast-in-Place Concrete

1.2 REFERENCES

- A. ASTM International
 - 1. ASTM E1745-17: Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
 - 2. ASTM E1643-18a: Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- B. Technical Reference - American Concrete Institute (ACI):
 - 1. ACI 302.2R-06: Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
 - 2. ACI 302.1R-15: Guide to Concrete Floor and Slab Construction.

1.3 SUBMITTALS

- A. Quality control/assurance:
 - 1. Summary of test results per paragraph 9.3 of ASTM E1745.
 - 2. Manufacturer's samples and literature.
 - 3. Manufacturer's installation instructions for placement, seaming, penetration prevention and repair, and perimeter seal per ASTM E1643.
 - 4. All mandatory ASTM E1745 testing must be performed on a single production roll per ASTM E1745 Section 8.1.
 - 5. Contact vapor barrier manufacturer to schedule a pre-construction meeting and to coordinate a review, in-person or digital, of the vapor barrier installation.
 - 6. Vapor barrier manufacturer must warrant in writing (a) compliance with the designated ASTM E1745 classification, and (b) no manufacturing defects in the product for, at least, the Life of the Building.
 - 7. Manufacturer verify in writing 20 years in the industry with no reported product failures.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Vapor barrier shall have all the following qualities:
 - 1. Maintain permeance of less than 0.01 Perms [grains/(ft² · hr · inHg)] as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
 - 2. Other performance criteria:

- a. Strength: ASTM E1745 Class A.
 - b. Thickness: 15 mils minimum
 3. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1
 4. Warranty: (a) compliance with the designated ASTM E1745 classification, and (b) no manufacturing defects in the product for, at least, the Life of the Building.
- B. Vapor barrier products:
1. Basis of Design: Stego Wrap Vapor Barrier (15-mil) by Stego Industries LLC., (877) 464-7834 www.stegoindustries.com
 2. No Substitutions

2.2 ACCESSORIES

- A. Seams:
1. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
- B. Sealing Penetrations of Vapor barrier:
1. Stego Mastic by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
 2. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
- C. Perimeter/terminated edge seal:
1. Stego Crete Claw (textured tape) by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
 2. Stego Term Bar by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
 3. StegoTack Tape (double-sided sealant tape) by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
 4. One-sided seaming tape is not a recommended method of sealing at the terminated edge.
- D. Penetration Prevention:
1. Beast Foot by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
 2. Beast Form Stake by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com
- E. Vapor Barrier-Safe Hand Screed System
1. Beast Screed by Stego Industries, LLC, (877) 464-7834 www.stegoindustries.com.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Ensure that subsoil is approved by Architect or Geotechnical Engineer.
1. Level and compact base material.
- B. Contact vapor barrier manufacturer to schedule a pre-construction meeting and to coordinate a review, in-person or digital, of the vapor barrier installation.

3.2 INSTALLATION

- A. Install vapor barrier in accordance ASTM E1643.
1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.
 2. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments, such as dowels, water stops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself.
 - a. Seal vapor barrier to the entire slab perimeter using manufacturer's textured tape with a surface that creates a mechanical seal to freshly-placed concrete, per manufacturer's instructions.
 - OR
 - b. Seal vapor barrier to the entire perimeter wall or footing/grade beam with manufacturer's double-sided tape, or both termination bar and double-sided tape, per manufacturer's instructions. Ensure the concrete is clean and dry prior to adhering tape.
 3. Overlap joints 6 inches and seal with manufacturer's seam tape.
 4. Apply seam tape/textured tape/double-sided tape to a clean and dry vapor barrier.
 5. Seal all penetrations (including pipes) per manufacturer's instructions.
 6. Avoid the use of stakes driven through vapor barrier by utilizing vapor barrier-safe, peel-and-stick screed and forming penetration prevention systems. Ensure peel-and-stick adhesive base is fully adhered to the vapor barrier.
 7. Repair damaged areas with vapor barrier material of similar (or better) permeance, puncture and tensile.

END OF SECTION

**SECTION 03 1000
CONCRETE FORMING AND ACCESSORIES**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes cast-in-place concrete formwork, for the following:
1. Footings and/or piers.
 2. Foundation walls.
 3. Slabs-on-grade.
 4. Suspended slabs.
 5. Concrete toppings.
 6. Building frame members.
 7. Building walls.
- B. Related Sections:
1. Section 01 4523 "Testing and Inspection Services".
 2. Section 03 3000 "Cast In Place Concrete".
 3. Section 03 2000 "Concrete Reinforcing".
 4. Section 03 3816 "Unbonded Post Tensioned Concrete".

1.3 REFERENCES

- A. The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise.
1. American Concrete Institute (ACI):
 - a. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials
 - b. ACI 301 – Specifications for Structural Concrete for Buildings
 - c. ACI 318 – Building Code Requirements for Structural Concrete
 - d. ACI 347 – Guide to Formwork for Concrete
 - e. ACI SP-4 – Formwork for Concrete.

1.4 PERFORMANCE REQUIREMENTS

- A. Design and engineering of formwork, including shores, reshores, false work, bracing, and other temporary supports as well as determining when temporary supports and bracing can safely be removed after the specified curing time is the Contractor's responsibility.
- B. All components of the formwork shall be designed to support all loads imposed during construction including weight of construction equipment, live loads, and lateral loads due to wind and imbalance or discontinuity of building components.

- C. If any post tensioned members exist on the project, the formwork supporting those elements shall:
1. It is essential to take into account the stressing sequence of post-tensioned concrete in the design of the formwork. Any concrete element which is stressed can transfer its weight off the form work to the supporting concrete element in which case the forms for the supporting concrete element must be designed to support the entire load tributary of that element.
 2. Forms shall be designed and constructed to permit movement during stressing, both lifting and shortening of the concrete elements.
 3. Formwork supporting beams and girders shall be designed to support the weight of the beam or girder's entire tributary area.
 4. Formwork supporting post tensioned concrete elements shall not be removed until all concrete supported by the formwork has been fully stressed, but in no case shall the curing time before form removal be less than specified herein.
 5. Design, engineering and production of shop drawings for the form work shall be performed under the supervision of a professional engineer.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork. Shop drawings for layout of pan type forms, if they exist on the project. Layout only - information and details about the support of these forms is not required, as it is the responsibility of the Contractor and his registered engineer
1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.
- C. Manufacturer's product data and installation instruction for propriety materials used in exposed concrete work including form liners, release agents, form systems, ties, and accessories.
- D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
1. Location of construction joints is subject to approval of the Architect.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver form materials in manufacturer's packaging with installation instructions.
- B. Store off ground in ventilated and protected area to prevent deterioration from moisture or damage.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician. An experienced installer who has completed work similar in material,

design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in service performance.

- B. Testing Agency Qualifications: Refer Section 01 4523.
- C. Layout and measurement of concrete forms and embedment's, required for work, performed by a licensed surveyor employed by the contractor.
- D. Design, engineering and construction, and removal of formwork are the responsibility of the contractor.
- E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specifications for Structural Concrete."
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- F. Preinstallation Conference: Conduct conference at Project site.
 - 1. Before submitting design mixtures, review concrete design mixture and examine concrete procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete subcontractor.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
 - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Permanent Metal Forms for Slabs: Deck material, gauge and rib pattern shall be as noted on Drawings.
- E. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
 - 1. Pans shall be free of dents, irregularities, sag, rust or other deterioration.

2. In areas permanently exposed to view, provide one piece units, manufactured to length between beams or ribs, or segmented units with reinforced butt-joint splices.
- F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- H. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- I. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
 3. Furnish ties with integral water-barrier plates to walls indicated to receive damp proofing or waterproofing.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
1. Class A, 1/8 inch for smooth-formed finished surfaces.
 2. Class B, 1/4 inch
 3. Class C, 1/2 inch
 4. Class D, 1 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
1. Install keyways, reglets, recesses, and the like, for easy removal.
 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts that are attached to the formwork.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 3. Install dovetail anchor slots in concrete structures as indicated.
 - 4. Install accessories in accordance with manufacturer's instructions, level and plumb. Ensure items are not disturbed during concrete placement.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
 - 3. Determine compressive strength of in place concrete by testing representative field-cured test specimens according to ACI 301.

- B. Obtaining concrete compressive strength tests for the purposes of form removal shall be the responsibility of the Contractor.
- C. In the absence of cylinder tests, formwork shall remain in place until the concrete has cured at a temperature of at least 50 degrees Fahrenheit (10 degrees Celsius) for the minimum cumulative time periods given in ACI 347, Section 3.7.2.3. When the surrounding air temperature is below 50 degrees Fahrenheit (10 degrees Celsius), that time period shall be added to the minimum listed time period.
- D. Formwork for two-way conventionally reinforced slabs shall remain in place for at least the minimum cumulative time periods specified for one-way slabs of the same maximum span. Two-way conventionally reinforced slabs shall then be reshored until they attain the specified 28 day strength.
- E. Minimum cumulative curing times may be reduced by the use of high-early strength cement or forming systems that allow form removal without displacing shores. However, the Contractor must demonstrate, to the satisfaction of the Architect, that the early removal of forms will not result in excessive sag, distortion or damage to the concrete elements.
- F. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- G. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORES AND RESHORES

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
 - 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. The Contractor shall be solely responsible for proper shoring and reshoring. Locate and provide adequate reshoring to support construction without excessive stress or deflection.
- C. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement. Reshores shall be located in the same position on each floor. No construction loads shall be placed on the new construction until all supporting reshores have been installed.
 - 1. Extend shores or reshores from ground to top level in structure three stories or less in height, unless noted otherwise.
 - 2. In structures over three stories in height, extend shores or reshores at least three levels under the level being placed. Extend shores beyond the minimum number of levels if required to ensure proper distribution of loads throughout the structure.
 - 3. In crawl spaces or basement, shores or reshores shall extend to mud pads seated firmly on the soil or to on grade construction.
- D. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

- E. Bottom tier of reshores shall remain in place until the supported concrete has attained at least 85 percent of the specified 28 day compressive strength and construction loads in excess of 20 psf have been removed but not less than 14 days.

3.5 REUSE OF FORMS

- A. Clean and repair surfaces of forms to be used in the Work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form release agent.
- B. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 - 5. Space vertical joints in walls as indicated. Otherwise, locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 - 6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants are to be installed.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
- C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
1. Apply scratch finish to surfaces indicated or to receive concrete floor toppings or to receive mortar setting beds for bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots.

Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated or to receive trowel finish or to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

3.9 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment

END OF SECTION

**SECTION 03 2000
CONCRETE REINFORCING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes cast-in-place concrete reinforcement, for the following:
1. Footings and/or piers.
 2. Foundation walls.
 3. Slabs-on-grade.
 4. Suspended slabs.
 5. Concrete toppings.
 6. Building frame members.
 7. Building walls.
- B. Related Sections:
1. Section 01 4523 "Testing and Inspection Services".
 2. Section 03 1000 "Concrete Forming and Accessories".
 3. Section 03 3000 "Cast In Place Concrete".
 4. Section 03 3816 "Unbonded Post Tensioned Concrete".
 5. Section 04 2200 "Concrete Unit Masonry".
 6. Section 31 2000 "Earth Moving".
 7. Section 31 6329 "Drilled Concrete Piers and Shafts".

1.3 REFERENCES

- A. The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise.
1. American Concrete Institute (ACI)
 - a. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials.
 - b. ACI 301 – Specifications for Structural Concrete for Buildings
 - c. ACI 315 – Details and Detailing of Concrete Reinforcement
 - d. SP-66 ACI Detailing Manual
 2. American Welding Society (AWS)
 - a. AWS D1.1 – Structural Welding Code
 3. Concrete Reinforcing Steel Institute (CRSI)
 - a. CRSI – Manual of Standard Practice
 - b. CRSI 63 – Recommended Practice for Placing Reinforcing Bars
 - c. CRSI 65 – Recommended Practice for Placing Bar Supports, Specifications and Nomenclature.

- B. American Society of Testing Materials (ASTM)
 - a. ASTM-A185: Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete Reinforcement.
 - b. ASTM-A663: Standard Specification for Steel Bars, Carbon, Merchant Quality, Mechanical Properties.
 - c. ASTM-A615: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - d. ASTM-A675: Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.
 - e. ASTM-A706: Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
 - f. ASTM-A775: Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
 - g. ASTM-A884: Standard Specification for Epoxy-Coated Wire and Welded Wire Reinforcement.

- C. In the case of conflict between the Contract Documents and a reference standard, the Contract Documents shall govern. In the case of a conflict between the Contract Documents and the Building Code, the more stringent shall govern.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement, according to ACI 315 "Details and Detailing of Concrete Reinforcement."
 - 1. Do not reproduce the structural drawings for use as shop drawings.

- C. Bar Supports: Submit manufacturer's product information for bolsters, chairs, spaces, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency, installer, and fabricator as indicated herein.

- B. Welding certificates.

- C. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Steel reinforcement and accessories.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Refer Section 01 4523.

- B. Installer Qualifications: An experienced installer who has completed reinforcing installation work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in service performance.
- C. Fabricator Qualifications: An experienced fabricator who has completed reinforcing fabrication work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in service performance.
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code - Reinforcing Steel."
- E. Preinstallation Conference: Conduct conference at Project site.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete subcontractor.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings, if any, on steel reinforcement.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Reinforcing Bars: ASTM A 615, Grade 60 for #6 and smaller bars, Grade 75 for #7 and larger bars, deformed.
- C. Low-Alloy-Steel Reinforcing Bars for bars to be welded: ASTM A 706, Grade 60 for #6 and smaller bars, Grade 75 for #7 and larger bars, deformed.
- D. Stainless-Steel Reinforcing Bars: ASTM A 955, Grade 60, [Type 304] [Type 316L], deformed.
- E. Steel Bar Mats: ASTM A 184, fabricated from ASTM A 615, Grade 60 or ASTM A 706, deformed bars, assembled with clips.
- F. Plain-Steel Wire: ASTM A 82, as drawn .

- G. Deformed-Steel Wire: ASTM A 496.
- H. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.
- I. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

2.2 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
 - 2. Use wire bar type supports complying with CRSI recommendations, unless otherwise indicated. Do not use wood, brick, or other unacceptable materials.

2.3 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice." Combined tolerances for formwork, reinforcing fabrication, and reinforcing placement shall not permit a reduction in specified concrete cover of reinforcing steel. In case of fabricating errors, do not re-bend or straighten reinforcement in a manner that will injure or weaken material. Bars used for concrete reinforcement shall meet following requirements for fabricating tolerances:
 - 1. Sheared length: Plus or minus 1 inch.
 - 2. Depth of truss bars: Plus 0, minus ½ inch.
 - 3. Overall dimensions of stirrups, ties, and spirals: Plus or minus ½ inch.
 - 4. Other bends: Plus or minus 1 inch.
- B. For bars with end bearing splice couplers, bar ends shall terminate in flat surfaces, within 1.5 degrees of a right angle to axis of bars and shall be fitted within 3 degrees of full bearing after assembly.

2.4 DOWEL BAR ANCHORS/SPLICERS

- A. A. Provide dowel bar anchors and threaded dowels designed to develop, both in tension and compression, 125% of the minimum ASTM specified yield strength of the dowel bars, as evidenced by published I.C.B.O. test reports. Unless otherwise indicated, anchors shall be furnished with ACI standard 90 degree hooks. Dowels shall be furnished by anchor supplier. The following dowel splicing systems are acceptable:
 - 1. Richmond Screw Anchor "Dowel Bar Splicer"
 - 2. Erico "Lenton Form Saver"
 - 3. Dayton Barsplice "Grip-Twist"

2.5 MECHANICAL SPLICES

- A. A. Provide mechanical splices designed to develop, both in tension and compression, 125% of minimum ASTM yield strength of the smaller bar being coupled, as evidenced by published I.C.B.O test reports. The following bar splicing systems are acceptable.
 - 1. Erico “Cadweld C-Series”
 - 2. Erico “Lenton”
 - 3. Dayton Barsplice “Bar Grip”
 - 4. Dayton Barsplice “Grip Twist”

2.6 METAL ANCHORAGE AND EMBEDDED METAL ASSEMBLIES

- A. Steel Shapes and Plates: Conform to ASTM A36, “Specification for Structural Steel”.
- B. Headed Stud Anchors: Headed studs welded by full fusion process, as furnished by TRW Nelson Stud Welding Division.
- C. Welding Electrodes: AWS 5.5, Series E70.
- D. Welded Deformed Bar Anchors: Welded by full fusion process, as furnished by TRW Nelson Stud Welding Division.
- E. All metal assemblies exposed to earth, weather or moisture, including exposure to a crawl space environment, shall be hot dip galvanized.

2.7 FABRICATION OF METAL ACCESSORIES AND EMBEDDED METAL ASSEMBLIES

- A. Fabricate and assemble structural steel items in the shop. Shearing, flame cutting, and chipping shall be done carefully and accurately. Holes shall be cut, drilled, or punched at right angles to the surface of metal and shall not be made or enlarged by burning. Holes shall be clean-cut without torn or ragged edges. Welded construction shall conform to AISC “Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings,” and AWS D1.1. Welding shall be done by AWS certified welders.
- B. Welding of deformed bar anchors and headed stud anchors shall be done by full fusion process equal to that of TRW Nelson Stud Welding Division of KSM Welding Services Division, Omark, Ind. A minimum of two headed studs shall be tested at start of each production period for proper quality control. Studs shall be capable of being bent 45 degrees without weld failure.
- C. Welding of reinforcement shall be done in strict accordance with AWS requirements, using recommended preheat temperature and electrode for type of reinforcement being welded. Bars larger than No. 9 shall not be welded. Welding shall be performed subject to the observance and testing laboratory. Under no circumstances is ordinary reinforcing (ASTM A615) to be welded.
- D. Coatings, where required, shall be applied after fabrication and prior to casting concrete.

PART 3 - EXECUTION

3.1 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 3. Install dovetail anchor slots in concrete structures as indicated.

3.2 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Weld reinforcing bars according to AWS D1.4, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- F. Provide minimum concrete covering for reinforcement as shown in the Structural General Notes.
- G. Place bars to following tolerances:
 - 1. Clear distance to formed surfaces: Plus or minus ¼ inch.
 - 2. Minimum spacing between bars: Minus ¼ inch.
 - 3. Top bars in slabs and beams:
 - a. Members 8 inches deep or less: Plus or minus ¼ inch.
 - b. Members between 8 and 24 inches deep: Plus or minus ½ inch.
 - c. Members more than 24 inches deep: Plus or minus 1 inch.
 - 4. Crosswise of members: Spaced evenly within 2 inches.
 - 5. Length of members: Plus or minus 2 inches.

- H. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items. If moved more than one bar diameter, or enough to exceed above tolerances, resulting arrangement of bars subject to approval.
- I. Support reinforcement and fasten together to prevent displacement by construction loads or placing concrete beyond tolerances indicated.
- J. Unless permitted by Engineer, do not bend reinforcement after embedding in hardened concrete.

3.3 FIELD QUALITY CONTROL

- A. Testing and Inspecting: See Section 01 4523.
- B. Inspections:
 - 1. Steel reinforcement placement.
 - 2. Steel reinforcement welding.

END OF SECTION

**SECTION 03 3000
CAST-IN-PLACE CONCRETE**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
1. Footings.
 2. Foundation walls.
 3. Slabs-on-grade.
 4. Suspended slabs.
 5. Concrete toppings.
 6. Building frame members.
 7. Building walls.
 8. Repair overlayment at stage flooring and elsewhere, where indicated.
- B. Related Sections:
1. Section 01 4523 "Structural Testing and Inspection Services".
 2. Section 03 2000 "Concrete Forming and Accessories".
 3. Section 03 1000 "Concrete Reinforcing".
 4. Section 03 0580 "Under-slab Vapor Barrier – Retarder".
 5. Section 31 6329 "Drilled Concrete Piers and Shafts".

1.3 REFERENCES

- A. The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise.
1. ACI 301 – Specification for Structural Concrete.
 2. ACI 302 – Guide for Concrete Floor Slab Construction.
 3. ACI 304 – Guide for Measuring, Mixing, Transporting and Placing Concrete.
 4. ACI 305 – Hot Weather Concreting.
 5. ACI 306 – Cold Weather Concreting.
 6. ACI 308 – Guide to Curing Concrete.
 7. ACI 309 – Guide for Consolidating Concrete.
 8. ACI 311 – ACI Manual for Concrete Inspection.
 9. ACI 318 – Building Code Requirements for Reinforced Concrete.
 10. ACI 347 – Guide to Concrete Formwork.
 11. ACI 207 – Mass Concrete.
 12. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.

13. ACI 211.2 – Standard Practice for Selecting Proportions for Structural Lightweight Concrete.
14. ACI 212.3 – Chemical Admixture for Concrete.
15. ACI 212.4 – Guide for the use of High Range Water Reducing Admixtures in Concrete.
16. ACI 214 – Evaluation of Strength Test Results of Concrete.
17. ACI 303 – Guide to Cast in Place Architectural Concrete Practice.
18. Concrete Reinforcing Steel Institute, “Manual of Standard Practice”.

- B. In the case of conflict between the Contract Documents and a referenced standard, the Contract Documents shall govern. In the case of a conflict between the Contract Documents and the Building Code, the more stringent shall govern.

1.4 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture include the following information. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
1. Each proposed mix design shall be accompanied by a complete standard deviation analysis based on at least 30 consecutive strength tests, or by three laboratory trial mixtures with confirmation tests.
 2. Proportions of cement, fine, and coarse aggregate, and water.
 3. Design strength.
 4. Maximum slump.
 5. Air Content.
 6. Maximum water / cement ratio.
 7. Maximum and minimum concrete temperature that is acceptable at time of placement for which the manufacturer can guarantee the strength of the concrete.
 8. Type cement and aggregates.
 9. Type and quantities of all admixtures.
 10. Air dry density and splitting tensile strength for lightweight concrete determined in accordance with ASTM 330.
 11. Type, color, and quantities of integral coloring compounds, where applicable.
 12. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Refer Section 03 2000.
- D. Formwork Shop Drawings: Refer Section 03 1000.
- E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
1. Location of construction joints is subject to approval of the Architect.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Welding certificates.
- C. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Fiber reinforcement.
 - 4. Curing compounds.
 - 5. Floor and slab treatments.
 - 6. Bonding agents.
 - 7. Adhesives.
 - 8. Semi rigid joint filler.
 - 9. Joint-filler strips.
 - 10. Repair materials.
- D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- F. Field quality-control reports.
- G. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: See Section 01 4523.
 - 1. Contractor's responsibility to testing laboratory.
 - a. Furnish all labor and materials as required to assist testing agency in obtaining, making and handling samples at the jobsite.
 - b. Advise the Owner's Testing Laboratory sufficiently in advance of operations to allow adequate time for the assignment of testing personnel.
 - c. Furnish and maintain adequate facilities for proper curing of concrete test specimens on the project site in accordance with ASTM C31.

- D. Moisture Vapor Reduction Admixture Testing Agent Qualifications:
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- E. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- F. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code - Reinforcing Steel."
- G. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specifications for Structural Concrete."
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- H. Mockups: Cast concrete slab-on-grade and formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.
 - 1. Build panel approximately 200 sq. ft. for slab-on-grade and 100 sq. ft. for formed surface in the location indicated or, if not indicated, as directed by Architect.
- I. Preinstallation Conference: Conduct conference at Project site.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete subcontractor.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings, if any, on steel reinforcement.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.9 WARRANTY

- A. Moisture Vapor Reduction Admixture (MVRA):
 - 1. MVRA must be installed according to, and in compliance with, the manufacturer's published data sheets to include, but not limited to:
 - a. Dosing instructions.
 - b. Onsite representation requirements.
 - c. Use of an ASTM E 1745 vapor retarder installed following ASTM E 1643 and ASTM F710 guidelines.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. See Section 03 1000.

2.2 STEEL REINFORCEMENT

- A. See Section 03 2000.

2.3 REINFORCEMENT ACCESSORIES

- A. See Section 03 2000.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I or Type I/II, gray. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class F or C. Carbon content shall not exceed 3 percent by volume.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years of satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
 - 1. Maximum Coarse-Aggregate Size: 1-1/2 inches, 1 inch, or 3/4 inch nominal as indicated on Drawings for specific uses.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Lightweight Aggregate: ASTM C 330, 3/4-inch nominal maximum aggregate size.
- D. Water: ASTM C 94 and potable.

2.5 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that contain not more than 0.05 percent water soluble chloride ions. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494, Type A.
 - 2. Retarding Admixture: ASTM C 494, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.
- C. Moisture Vapor Reduction Admixture: For use in all interior slabs and elevated floor slabs on metal deck.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Barrier One Incorporated; High Performance Concrete Admixture or comparable product by one of the following:
 - a. Vaporlock 20/20: Concrete Admixture
 - b. Moxie International, Inc.; Moxie Shield 1800 Admixture
 - c. ISE Logik Industries, Inc.; MVRS 900
 - d. Failure to provide a product that meets or exceeds the MVRA warranty requirements of Part I and the MVRA field quality control requirements of Part 3 will result in all subsequent testing and slab remediation costs being borne by the ready mix supplier.
 2. Description: Concrete moisture vapor reduction admixture for all interior slabs on ground and elevated floor slabs on metal deck shall be a non-toxic liquid admixture specifically designed to have a natural chemical reaction with pre-existing elements inside the concrete to eliminate the route of moisture vapor emission through the slab by restricting the integral capillary system. Chemical reaction shall form a permanent barrier (capillary break) that is integral to the concrete, insoluble, and irremovable.

2.6 FIBER REINFORCEMENT

- A. Synthetic Macro-Fiber: Polyolefin macro-fibers engineered and designed for use in concrete, complying with ASTM C 1116, Type III, 1 to 2-1/4 inches long.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. 3M; Scotchcast Polyolefin Fibers 2".
 - b. Euclid Chemical Company (The), an RPM company; Tuf-Strand SF.
 - c. FORTA Corporation; FORTA FERRO.
 - d. Grace Construction Products, W. R. Grace & Co.; Strux 90/40.
 - e. Nycon, Inc.; XL.
 - f. Propex Concrete Systems Corp.; Fibermesh 650.
 - g. Sika Corporation; Sika Fiber MS or MS10.

2.7 CONCRETE MIX DESIGNS

- A. Selection of Proportions: Proportions of ingredients for concrete mixes shall be determined by a qualified concrete supplier in accordance with the requirements of ACI 301.
- B. Required average strength above specified strength: Determination of required average strength above specified strength shall be based on the standard deviation record of the production facility in accordance with ACI 301. Calculation of standard deviation of compressive strength results shall be made in accordance with ACI 214. If a suitable record of strength tests is not available, proportions shall be selected on the basis of laboratory trial batches to produce an average strength greater than the strength $f'c$ by the amount defined in ACI 301.

2.8 VAPOR RETARDERS

- A. See Section 03 0580.

2.9 FLOOR AND SLAB TREATMENTS

- A. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, non-glazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials with 100 percent passing No. 8 sieve.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Anti-Hydro International, Inc.; Emery.
 - b. Dayton Superior Corporation; Emery Tuff Non-Slip.
 - c. Lambert Corporation; EMAG-20.
 - d. L&M Construction Chemicals, Inc.; Grip It.
 - e. Metalcrete Industries; Metco Anti-Skid Aggregate.
- B. Slip-Resistive Aluminum Granule Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of not less than 95 percent fused aluminum-oxide granules.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Anti-Hydro International, Inc.; A-H Alox.
 - b. BASF Construction Chemicals - Building Systems; Frictex NS.
 - c. L&M Construction Chemicals, Inc.; Grip It AO.

2.10 LIQUID FLOOR TREATMENTS

- A. VOC Content: Liquid floor treatments shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ChemMasters; Chemisil Plus.
 - b. ChemTec Int'l; ChemTec One.
 - c. Conspec by Dayton Superior; Intraseal.
 - d. Curecrete Distribution Inc.; Ashford Formula.
 - e. Dayton Superior Corporation; Day-Chem Sure Hard (J-17).
 - f. Edoco by Dayton Superior; Titan Hard.
 - g. Euclid Chemical Company (The), an RPM company; Euco Diamond Hard.
 - h. Kaufman Products, Inc.; SureHard.
 - i. L&M Construction Chemicals, Inc.; Seal Hard.
 - j. Meadows, W. R., Inc.; LIQUI-HARD.
 - k. Metalcrete Industries; Floorsaver.
 - l. Nox-Crete Products Group; Duro-Nox.
 - m. Symons by Dayton Superior; Buff Hard.
 - n. US SPEC, Division of US Mix Products Company; US SPEC Industraseal.
 - o. Vexcon Chemicals, Inc.; Vexcon StarSeal PS Clear.

- C. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Advanced Floor Products; Retro-Plate 99.
 - b. L&M Construction Chemicals, Inc.; FGS Hardener Plus.
 - c. QuestMark, a division of CentiMark Corporation; DiamondQuest Densifying Impregnator Application.

2.11 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Axim Italcementi Group, Inc.; CATEXOL CimFilm.
 - b. BASF Construction Chemicals - Building Systems; Confilm.
 - c. ChemMasters; SprayFilm.
 - d. Conspec by Dayton Superior; Aquafilm.
 - e. Dayton Superior Corporation; Sure Film (J-74).
 - f. Edoco by Dayton Superior; BurkeFilm.
 - g. Euclid Chemical Company (The), an RPM company; Eucobar.
 - h. Kaufman Products, Inc.; Vapor-Aid.
 - i. Lambert Corporation; LAMBCO Skin.
 - j. L&M Construction Chemicals, Inc.; E-CON.
 - k. Meadows, W. R., Inc.; EVAPRE.
 - l. Metalcrete Industries; Waterhold.
 - m. Nox-Crete Products Group; MONOFILM.
 - n. Sika Corporation; SikaFilm.
 - o. SpecChem, LLC; Spec Film.
 - p. Symons by Dayton Superior; Finishing Aid.
 - q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
 - r. Unitex; PRO-FILM.
 - s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
 - b. BASF Construction Chemicals - Building Systems; Kure 200.
 - c. ChemMasters; Safe-Cure Clear.
 - d. Conspec by Dayton Superior; W.B. Resin Cure.
 - e. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
 - f. Edoco by Dayton Superior; Res X Cure WB.

- g. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
 - h. Kaufman Products, Inc.; Thinfilm 420.
 - i. Lambert Corporation; AQUA KURE - CLEAR.
 - j. L&M Construction Chemicals, Inc.; L&M Cure R.
 - k. Meadows, W. R., Inc.; 1100-CLEAR.
 - l. Nox-Crete Products Group; Resin Cure E.
 - m. Right Pointe; Clear Water Resin.
 - n. SpecChem, LLC; Spec Rez Clear.
 - o. Symons by Dayton Superior; Resi-Chem Clear.
 - p. TK Products, Division of Sierra Corporation; TK-2519 DC WB.
 - q. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.
- F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Construction Chemicals - Building Systems; Kure 1315.
 - b. ChemMasters; Polyseal WB.
 - c. Conspec by Dayton Superior; Sealcure 1315 WB.
 - d. Edoco by Dayton Superior; Cureseal 1315 WB.
 - e. Euclid Chemical Company (The), an RPM company; Super Diamond Clear VOX; LusterSeal WB 300.
 - f. Kaufman Products, Inc.; Sure Cure 25 Emulsion.
 - g. Lambert Corporation; UV Safe Seal.
 - h. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
 - i. Meadows, W. R., Inc.; Vocomp-30.
 - j. Metalcrete Industries; Metcure 30.
 - k. Right Pointe; Right Sheen WB30.
 - l. Symons by Dayton Superior; Cure & Seal 31 Percent E.
 - m. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.
 - 2. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.12 RELATED MATERIALS

- A. Expansion and Isolation Joint Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Semi-rigid Joint Filler: Two-component, semi-rigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.
- C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

- E. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.13 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109.

2.14 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of Portland cement, which would otherwise be used, as indicated in Structural General Notes.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.15 NON-SHRINK GROUT

- A. Grout shall be prepackaged, non metallic, and non gaseous. It shall be non-shrink when tested in accordance with ASTM-C1107 Grade B or C at a fluid consistency (flow cone) of 20 to 30 seconds. Thirty-minute-old grout shall flow through the flow cone after slight agitation, in temperatures of 40 degrees to 90 degrees Fahrenheit. Grout shall be bleed free and attain 7,500 psi compressive strength in 28 days at fluid consistency. Certified independent test data required. Approved products include the following:
 1. "Euco NS" by Euclid Chemical Company
 2. "Masterflow 713" by Master Builders.

2.16 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Proportion normal-weight concrete mixture as indicated in Structural General Notes.
- B. Slabs at grade and elevated slabs on deck: Comply with Paragraph 2.18A and as follows:
 1. Moisture Vapor Reduction Admixture: Dose at 14 ounces per 100 pounds of total cementitious materials. Remove an equal part of water from the mix. Add separately from other admixtures at the tail end of the load.

2.17 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.18 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.
 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

- A. See Section 03 1 00.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

- A. See Section 03 1000.

3.4 SHORES AND RESHORES

- A. See Section 03 1000.

3.5 VAPOR RETARDERS/BARRIERS

- A. See Section 03 0580.

3.6 STEEL REINFORCEMENT

- A. See Section 03 20 00

3.7 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 - 5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 - 6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants are specified or otherwise indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Do not permit concrete to drop freely any distance greater than 10'-0" for concrete containing a high range water reducing admixture or 5'-0" for other concrete. Provide chute or tremie to place concrete where longer drops are necessary. Do not place concrete into excavations with standing water. If place of deposit cannot be pumped dry, pour concrete through a tremie with its outlet near the bottom of the place of deposit.
- F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleed water appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- G. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- H. Hot-Weather Placement: Comply with ACI 305 and as follows:
 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

- A. See Section 03 10 00.

3.10 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
 - 1. Apply scratch finish to surfaces indicated and/or to receive concrete floor toppings or to receive mortar setting beds for bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces indicated and/or to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces indicated and/or exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 - 2. Finish surfaces according to ASTM E 1155, for a randomly trafficked floor surface.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated or where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
 - 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.11 CONCRETE FLOOR FINISH TOLERANCES

- A. Interior Finish Floor surfaces to the following tolerances, measured within 24 hours according to ASTM E 1155, "Standard Test Method for Determining Floor Flatness and Levelness Using the F-Number System." The following values apply before removal of shores. Levelness values F(L) do not apply to intentionally sloped or cambered areas, nor to slabs poured on metal deck or precast concrete.
 - 1. Exposed, vinyl tiled, or thin-set tiled floors: Specified overall values of flatness, Ff =35; and levelness, FI =25; with minimum local values of flatness, Ff =24; and levelness, FI =17.

2. Carpeted floors, floors under concrete toppings, thickset tile and terrazzo: Specified overall values of flatness, $F_f = 25$; and levelness, $F_l = 20$; with minimum local values of flatness, $F_f = 17$; and levelness, $F_l = 15$.

B. Floor Elevation Tolerance Envelope:

1. The acceptable tolerance envelope for absolute elevation of any point on the slab surface, with respect to the elevation shown on the Drawings, is as follows:
 - a. Slab-on-Grade, or Slab-on-Void Construction: $\pm 3/4"$
 - b. Top surfaces of formed slabs measured prior to removal of supporting shores: $\pm 3/4"$
 - c. Top surfaces of all other slabs: $\pm 3/4"$
 - d. Slabs specified to slope shall have a tolerance from the specified slope of $3/8"$ in $10'-0"$ at any point, up to $3/4"$ from theoretical elevation at any point.

3.12 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.13 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching $0.2 \text{ lb/sq. ft.} \times h$ before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
 - 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least six month(s). Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semi-rigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.
 - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 - 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 - 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching

concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
 - F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.16 FIELD QUALITY CONTROL

- A. Testing and Inspecting: See Section 01 4523.
 1. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 2. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION

**SECTION 03 3543
BONDED ABRASIVE POLISHED CONCRETE FLOORS**

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Products and procedures for bonded abrasive polishing concrete floors using multi-step wet/dry mechanical process, and accessories indicated, specified, or required to complete polishing.

1.02 DEFINITIONS

- A. Terminology: As defined by CPAA.
- B. Polished Concrete: The act of changing a concrete floor surface, with or without aggregate exposure, to achieve a specified level of gloss.
- C. Bonded Abrasive Polished Concrete: The multi-step operation of mechanically grinding, honing, polishing of a concrete floor surface with bonded abrasives to cut a concrete floor surface and to refine each cut to the maximum potential to achieve a specified level of finished gloss as defined by the CPAA.

1.03 SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required. Include manufacturer's technical data, application instructions, and recommendations.
- B. Installer Qualifications: Data for company, principal personnel, experience, and training specified in PART 1 "Quality Assurance" Article.
- C. Field Quality Control – Dynamic Coefficient of Friction Test Reports: Reports of testing specified in PART 3 "Field Quality Control" Article.
- D. Field Quality Control – Static Coefficient of friction test reports: report of testing specified in Part 3 "Field Quality Control" article.
- E. Maintenance Data: For inclusion in maintenance manual required by Division 01.
 - 1. Include instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
 - 2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.04 QUALITY ASSURANCE

- A. Polisher Qualifications:
 - 1. Experience: Company experienced in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce specified work.
 - 2. Supervision: Maintain competent supervisor who is at Project during times specified work is in progress, and is currently certified as Craftsman - Level I or higher by CPAA.
 - 3. Manufacturer Qualification: Approved by manufacturer to apply liquid applied products.
- B. Walkway Auditor: Certified by CPAA or NFSI to test bonded abrasive polished concrete floors for dynamic and static coefficient of friction according to ANSI B101.1 and B101.3.
- C. Coefficient of Friction: Achieve following coefficient of friction by field quality control testing in accordance to the following standards:
 - 1. ANSI B101.1 Static Coefficient of Friction - Achieve a minimum of .42 for level floor surfaces.
 - 2. ANSI B101.3 Dynamic Coefficient of Friction - Achieve a minimum of .35 for level floor surfaces.

- D. Field Mock-up: Before performing work of this Section, provide following field mock-up to verify selections made under submittals and to demonstrate aesthetic effects of polishing. Approval does not constitute approval of deviations from Contract Documents, unless Architect specifically approves deviations in writing.
1. Form, reinforce, and cast concrete slab for 10 foot square field mock-up.
 2. Concrete shall be same mix design as scheduled for Project.
 3. Placement and finishing work shall be performed by same personnel as will place and finish concrete for Project.
 4. Mock-up shall be representative of work to be expected.
 5. Perform grinding, honing, and polishing work as scheduled for Project using same personnel as will perform work for Project.
 6. Approval is for following aesthetic qualities:
 - a. Compliance with approved submittals.
 - b. Compliance with specified aggregate exposure.
 - c. Compliance with specified finished gloss level.
 7. Obtain Architect's approval before starting work on Project.
 8. Protect and maintain approved field mock-ups during construction in an undisturbed condition as a standard for judging completed work.
- E. Pre-Installation of Concrete Conference: Prior to placing concrete for areas scheduled for polishing, conduct conference at Project to comply with requirements of applicable Division 01 Sections.
1. Required Attendees:
 - a. Owner.
 - b. Architect.
 - c. Contractor, including supervisor.
 - d. Concrete producer.
 - e. Concrete finisher, including supervisor.
 - f. Concrete polisher, including supervisor.
 - g. Technical representative of liquid applied product manufacturers.
 - h. Walkway auditor.
 2. Minimum Agenda: Polisher shall demonstrate understanding of work required by reviewing and discussing procedures for, but not limited to, following:
 - a. Tour field mock-up and representative areas of required work, discuss and evaluate for compliance with Contract Documents, including substrate conditions, surface preparations, sequence of procedures, and other preparatory work performed by other installers.
 - b. Review Contract Document requirements.
 - c. Review approved submittals and field mock-up.
 - d. Review procedures, including, but not limited to:
 - e. Applicable Division 03 Section on cast-in-place concrete
 - 1) Specific mix design.
 - 2) Specified curing methods/procedures.
 - 3) Projected 3, 10, and 28 day compression strength test related to specified aggregates exposure for finished floor and project phasing.
 - 4) Protection of concrete substrate during construction and prior to polishing process
 - 5) Project phasing and scheduling for each step of grinding, honing and polishing operations including, but not limited to:
 - (a) Quality of qualified personnel committed to project.
 - (b) Quality and size of grinders committed to project.
 - (c) Proper disposal of concrete slurry and/or concrete dust.

- 6) Details of each step of grinding, honing, and polishing operations.
 - (a) Application of liquid applied products.
 - (b) Protecting polished concrete floors after polishing work is complete.
3. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

1.05 FIELD CONDITIONS

- A. Damage and Stain Prevention: Take precautions to prevent damage and staining of concrete surfaces to be polished.
 1. Prohibit use of markers, spray paint, and soapstone.
 2. Prohibit improper application of liquid membrane film forming curing compounds.
 3. Prohibit vehicle parking over concrete surfaces.
 4. Prohibit pipe-cutting operations over concrete surfaces.
 5. Prohibit storage of any items over concrete surfaces for not less than 28 days after concrete placement.
 6. Prohibit ferrous metals storage over concrete surfaces.
 7. Protect from petroleum, oil, hydraulic fluid, or other liquid dripping from equipment working over concrete surfaces.
 8. Protect from acids and acidic detergents contacting concrete surfaces.
 9. Protect from painting activities over concrete surfaces.
- B. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting liquid applied product application.

PART 2 – PRODUCTS

2.01 LIQUID APPLIED PRODUCTS

- A. Liquid Densifier: An Aqueous solution of Silicon Dioxide dissolved in one of the following Hydroxides that penetrates into the concrete surface and reacts with the Calcium Hydroxide to provide a permanent chemical reaction that hardens and densifies the wear surface of the cementitious portion of the concrete. All of the following have the same chemistry varying only by the alkali used for solubility of the Silicon Dioxide.
 1. Sodium Silicate
 2. Potassium Silicate
 3. Lithium Silicate
 4. Alkalis solution of Colloidal Silicates or Silica

2.02 ACCESSORIES

- A. Repair Material: A product that is designed to repair cracks and surface imperfections. The specified material must have sufficient bonding capabilities to adhere after the polishing to the concrete surface and provide abrasion resistance equal to or greater than the surrounding concrete substrate.
- B. Grout Material: A thin mortar used for filling spaces. Acceptable products shall be:
 1. Epoxy, urethane, polyurea, or polyaspartic resins.
 2. Latex or acrylic binders mixed with cement dust from previous grinding steps.
 3. Silicate binders mixed with cement dust from previous grinding steps.
- C. Protective Cover: Non-woven, puncture and tear resistant, polypropylene fibers laminated with a multi-ply, textured membrane, not less than 18 mils in thickness.

2.03 POLISHING EQUIPMENT

- A. Field Grinding and Polishing Equipment:

1. A multiple head, counter rotating, walk behind or ride on machine, of various size and weights, with diamond tooling affixed to the head for the purpose of grinding concrete. Excludes janitorial maintenance equipment.
 2. If dry grinding, honing, or polishing, use dust extraction equipment with flow rate suitable for dust generated, with squeegee attachments.
 3. If wet grinding, honing, or polishing, use slurry extraction equipment suitable for slurry removal and containment prior to proper disposal.
- B. Edge Grinding and Polishing Equipment: Hand-held or walk-behind machines which produces same results, without noticeable differences, as field grinding and polishing equipment.
- C. Burnishing Equipment: High speed walk-behind or ride-on machines capable of generating 1000 to 2000 revolutions per minute and with sufficient head pressure of not less than 20 pounds to raise floor temperature by 20 degrees F.
- D. Diamond Tooling: Abrasive tools that contain industrial grade diamonds within a bonded matrix (such as metallic, resinous, ceramic, etc) that are attached to rotating heads to refine the concrete substrate.
1. Bonded Abrasive: Abrasive medium that is held within a bonding that erodes away to expose new abrasive medium as it is used.
 2. Metal Bond Tooling: Diamond tooling that contains industrial grade diamonds with a metallic bonded matrix that is attached to rotating heads to refine the concrete substrate. These tools are available in levels of soft, medium, and hard metallic matrices that are matched with contrasting concrete substrates (i.e. hard matrix/soft concrete, medium matrix/medium concrete, soft matrix/hard concrete) and are typically used in the grinding and early honing stages of the polishing process.
 3. Resin Bond Tooling: Diamond tooling that contains industrial grade diamonds within a resinous bonded matrix (poly-phenolic, ester-phenolic, thermoplastic-phenolic) that is attached to rotating heads to refine the concrete substrate. Resin bond tooling does not have the soft/medium/hard characteristics of metal bond tooling and are typically used for the later honing and polishing stages of the polishing process.
 4. Hybrid Tooling: Diamond tooling that combines metal bond and resin bond that has the characteristics of both types of tooling. These types of tools are typically used as either transitional tooling from metal bond tools to resin bond tools or as a first cut tool on smooth concrete surfaces.
 5. Transitional Tooling: Diamond tooling that is used to refine the scratch pattern of metal bond tooling prior to the application of resin bond tooling in an effort to extend the life of resin bond tooling and to create a better foundation for the polishing process.
 6. Abrasive Pad: An abrasive pad, resembling a typical floor maintenance burnishing pad, that has the capability of refining the concrete surface on a microscopic level that may or may not contain industrial grade diamonds. These pads are typically used for the maintenance and/or restoration of previously installed polished concrete flooring.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Acceptance of Surfaces and Conditions:
1. Examine substrates to be polished for compliance with requirements and other conditions affecting performance.
 - a. Concrete Finished Floor Flatness according to applicable Division 03 Section on cast-in-place concrete.
 - b. Concrete curing methods according to applicable Division 03 Section on cast-in-place concrete.
 - c. Concrete Compression strength per according to applicable Division 03 Section on cast-in-place concrete.

- B. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
- C. Starting work within a particular area will be construed as acceptance of surface conditions.

3.02 PREPARATION

- A. Cleaning New Concrete Surfaces:
 - 1. Prepare and clean concrete surfaces.
 - 2. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, paint splatter, and other contaminants incompatible with liquid applied products and polishing.

3.03 POLISHING CONCRETE FLOORS

- A. Perform all polishing procedures to ensure a consistent appearance from wall to wall.
- B. Initial Grinding:
 - 1. Use grinding equipment with metal or semi-metal bonded tooling.
 - 2. Begin grinding in one direction using sufficient size equipment and diamond tooling to meet specified aggregate exposure class.
 - 3. Make sequential passes with each pass perpendicular to previous pass using finer grit tool with each pass, up to 100 grit metal bonded tooling.
 - 4. Achieve maximum refinement with each pass before proceeding to finer grit tools.
 - 5. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
 - 6. Continue grinding until aggregate exposure matches approved field mock-ups.
- C. Treating Surface Imperfections:
 - 1. Mix patching compound or grout material with dust created by grinding operations, manufacturer's tint, or sand to match color of adjacent concrete surfaces.
 - 2. Fill surface imperfections including, but not limited to, holes, surface damage, small and micro cracks, air holes, pop-outs, and voids with grout to eliminate micro pitting in finished work.
 - 3. Work compound and treatment until color differences between concrete surface and filled surface imperfections are not reasonably noticeable when viewed from 10 feet away under lighting conditions that will be present after construction.
- D. Liquid Densifier Application: Apply undiluted to point of rejection, remove excess liquid, and allow curing according to manufacturers instructions.
- E. Grout Grinding:
 - 1. Use grinding equipment and appropriate grit and bond diamond tooling.
 - 2. Apply grout, forced into the pore structure of the concrete substrate, to fill surface imperfections.
 - 3. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
- F. Honing:
 - 1. Use grinding equipment with hybrid or resin bonded tooling.
 - 2. Hone concrete in one direction starting with a 100 grit tooling and make as many sequential passes as required to remove scratches, each pass perpendicular to previous pass, up to 400 grit tooling reaching maximum refinement with each pass before proceeding to finer grit tooling.
 - 3. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.

G. Polishing:

1. Use polishing equipment with resin-bonded tooling.
2. Begin polishing in one direction starting with 800 grit tooling.
3. Make sequential passes with each pass perpendicular to previous pass using finer grit tooling with each pass until the specified level of gloss has been achieved.
4. Achieve maximum refinement with each pass before proceeding to finer grit pads.
5. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
6. Stain Protection: Uniformly apply and remove excessive liquid according to manufacturer's instructions. Final film thickness should be less than .05 mils after cure.
7. Final Polish: Using burnishing equipment and finest grit abrasive pads, burnish to uniform reflective sheen matching approved field mock-up.

H. Final Polished Concrete Floor Finish:

1. Aggregate Exposure Class B - Fine / Sand Aggregate Finish: Remove not more than 1/16 inch of concrete surface by grinding and polishing resulting in majority of exposure displaying fine aggregate with no, or small amount of, medium aggregate at random locations.
2. Finished Gloss Level 3 - Semi-Polished Appearance:
 - a. Procedure: Recommended not less than 4 steps with full refinement of each diamond tool with one application of densifier.
 - b. Gloss Measurement: Determine the specular gloss by incorporating the following:
 - 1) Reflective Clarity Reading: Not less than 65 according to ASTM D5767 prior to the application of sealers.
 - 2) Reflective Sheen Reading: Not less than 35 according to ASTM D523 prior to the application of sealers.

1.02 FIELD QUALITY CONTROL

- A. Field Testing: Engage a qualified walkway auditor to perform field testing to determine if polished concrete floor finish complies with specified coefficient of friction;
1. ANSI B101.1 for static coefficient of friction
 2. ANSI B101.3 for dynamic coefficient of friction

1.03 CLOSEOUT ACTIVITIES

- A. Maintenance Training: CPAA Craftsman shall train Owner's designated personnel in proper procedures for maintaining polished concrete floor.

1.04 PROTECTION

- A. Covering: After completion of polishing, protect polished floors from subsequent construction activities with protective covering.

END OF SECTION

**SECTION 03 3800
POST-TENSIONED CONCRETE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cast-in-place post-tensioned concrete framing members and slabs.
- B. Sheathing-covered tensioning tendons for unbonded system.

1.02 RELATED REQUIREMENTS

- A. Section 03 1000 - Concrete Forming and Accessories.
- B. Section 03 2000 - Concrete Reinforcing: Reinforcement other than tensioning reinforcing.
- C. Section 03 3000 - Cast-in-Place Concrete: Concrete product, mix, and testing requirements; floor slab tolerances; curing and repair.
- D. Section 32 1828 - Tennis Courts: Included as part of the performance package. Soil preparation requirements.

1.03 REFERENCE STANDARDS

- A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).
- B. ACI 301 - Specifications for Concrete Construction; 2020.
- C. ACI 318 - Building Code Requirements for Structural Concrete; 2019 (Reapproved 2022).
- D. ASTM A416/A416M - Standard Specification for Low-Relaxation, Seven-Wire Steel Strand for Prestressed Concrete; 2018.
- E. CRSI (DA1) - CRSI Design Handbook; 2008.

1.04 DESIGN REQUIREMENTS

- A. Size components to withstand design loads as indicated on the drawings.
 - 1. Maximum Allowable Deflection: $1/360$ of span for live load.
- B. Design members exposed to the weather to accommodate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects, when subject to seasonal or cyclic day/night temperature changes.
- C. Design framing members in accordance with ACI 301, ACI 318, ACI 117.
- D. Design deformed bar concrete reinforcement work in accordance with CRSI (DA1) - CRSI Handbook.
- E. Design system to accommodate construction tolerances, deflection of other building structural members, and clearances of intended openings.
- F. Design drawings and calculations shall be prepared and sealed by a registered structural engineer in the State of Texas indicating method of elongation calculation including values used for friction coefficients, anchorage seating loss, elastic shortening, creep, relaxation and shrinkage.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.
 - 1. Discuss tendon locations, sleeve locations, and cautions regarding cutting or core drilling.

1.06 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for the following materials
 - 1. Concrete design mix and admixtures.

2. Post-tensioning coating
 3. Tendon sheathing
 4. Anchorage devices
 5. Tendon couplers
 6. Bar and tendon supports
 7. Pocket formers
 8. Sheathing repair tape
 9. Stressing-pocket patching material
- C. Shop Drawings: Indicate layout, tendon sizes, grouping, spacing, placing sequence, supports and locations, tendon supports, accessories, clearances required for jack, and pressure plate stresses.
1. Indicate formwork methods, materials, arrangement of joints, ties, shores, location of bracing and temporary supports, and schedule of erection and stripping.
 2. Describe tensioning sequence, type of jack, pressure monitoring device, anchorage set, tendon elongation and tendon cut-off procedures.
 3. Shop drawing sheets that include engineering information designed by the Contractor's Delegated Design Engineer shall be signed and sealed in accordance with the Texas Engineering Practice Act. Sheets that do not provide information designed by the Contractor's Engineer do not require being signed and sealed. Calculation packages require a signed and sealed cover sheet only. Any submittals requiring to be signed and sealed that are received without the signature and seal will be rejected without review.
- D. Design Data: Indicate calculations for loadings and stresses of tendon load elongation curves.
- E. Certificate: Certify that tendon strength characteristics meet or exceed specified requirements.
- F. Project Record Documents: Record actual locations of tendons; stressing sequence and tension loads established, and elongation of tendon .

1.07 QUALITY ASSURANCE

- A. Designer Qualifications: Under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in Texas.
- B. Installer Qualifications: Company specializing in performing the type of work specified in this section with minimum five years of documented experience, subject to the approval of the Architect.
- C. Welder Qualifications: Qualified within previous 12 months in accordance with AWS B2.1/B2.1M.

PART 2 PRODUCTS

2.01 FORMWORK

- A. Formwork: As specified in Section 03 1000.

2.02 REINFORCEMENT

- A. Tendon Strand: Factory assembled, ASTM A416/A416M, Grade 250 (1725) seven-wire stranded steel cable; low-relaxation type; full length without splices; weldless; covered with polyethylene sheathing providing free movement of tendon within sheathing; complete with end anchorages.
1. Unless otherwise approved in advance by the Architect, provide plastic wrapped post-tensioning strands composed of stress-relieved, high-tensile, cold-drawn 7-wire strand of 1/2" diameter, meeting requirements of ASTM A416 and the following.
 - a. Ultimate strength:270 Ksi
 - b. Temporary stress to overcome friction: 216 Ksi
 - c. Anchor stress:189 Ksi
 - d. Effective stress:162 Ksi

- e. Elongation: 0.081" per ft.
- 2. Provide mill tests and certificates.
 - a. Make two tests for each reel, and tag for identification purposes.
 - b. Assign an individual lot number to each size of wire, strand, or bar to be shipped to the site, and tag accordingly.
 - c. Provide manufacturer's written warranty that the post-tensioning material is of the strength specified.
- B. Tendon Anchor: Type compatible with tendon, of strength not less than tendon.
- C. Tendon Coupling: Type compatible with tendon, of strength equal to or greater than tendon after attachment to tendons.
- D. Supplementary Reinforcement: As specified in Section 03 2000.

2.03 ACCESSORIES

- A. Tendon Sheathing: Comply with ACI 423.6.
 - 1. Minimum Thickness: 0.050 inch (1.25 mm) for polyethylene or polypropylene with a minimum density of 0.034 lb/cu. in. (0.9 g/cu. cm).
 - 2. Retain first option in subparagraph below if an encapsulated system is specified. Retain second option if a non-encapsulated system is specified. Revise as necessary if an encapsulated system is specified only for certain portions of structure.
 - 3. Continuous over the entire length of tendon to provide watertight encapsulation of strand and between anchorages to prevent intrusion of cement paste or loss of coating for a non-encapsulated system.
- B. Sheathing Repair Tape: Elastic, self-adhesive, moisture proof tape with minimum width of 2 inches (50 mm), in contrasting color to tendon sheathing; non reactive with sheathing, coating, or prestressing steel.
- C. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Adhesive Tape Products, Inc.; PWT-20.
 - b. 3M; Tape 226.
 - c. Tyco Adhesives; Polyken 826.
- D. Tie Wire:
 - 1. Minimum 16 gage, 0.0508 inch diameter, annealed type.
 - 2. An acceptable patented system.
- E. Chairs, Bolsters, Bar Supports, Spacers: Size and shape for strength and support of reinforcement during tendon location, installation, and placement of concrete.
- F. Touch-up Primer: Corrosion resistive paint.

2.04 CONCRETE MATERIALS AND MIX DESIGN

- A. Concrete Materials: As specified in Section 03 3000 unless otherwise requested by the Contractor's Tennis Court Engineer and approved by the Architect.
- B. Mix Design: The Contractor's Tennis Court Engineer shall specify, review and approve the concrete mix design for the tennis court. The mix approved by the Tennis Court Engineer shall be submitted to the Architect for consideration. The mix design shall include the 28 day compressive strength, aggregate gradation requirements, slump range permitted, water/cement ratio, aggregate size limits, air entraining agent, fly ash content, type of fly ash used, and admixture data. It is acceptable to the Architect if the Contractor's Tennis Court Engineer allows use of the Specification Section 03 3000 mix design for "Exterior Slabs over Void Boxes and Exterior Slabs over any other Temporary Formwork".

2.05 SOURCE QUALITY CONTROL

- A. A Special Inspection and Testing Agency (SITA) will perform source quality control tests and inspections, as specified in Sections 01 4516 and 01 4533.

PART 3 EXECUTION

3.01 INSTALLERS

- A. Substitutions: Not permitted.

3.02 EXAMINATION

- A. Verify that site conditions are ready to receive work and field measurements are as indicated on Drawings.

3.03 FORMWORK ERECTION

- A. Construct and support formwork in accordance with Section 03 1000.
- B. Provide supports and working space for tensioning jacks.
- C. Install anchorage and connection devices.

3.04 TENDON PLACEMENT

- A. Install tendons according to approved installation drawings and procedures stated in PTI's "Field Procedures Manual for Unbonded Single Strand Tendons."
- B. Tendon Supports: Provide continuous slab bolsters or bars supported on individual high chairs spaced at a maximum of 42 inches (1070 mm) o.c. to ensure tendons remain in their designated positions during construction operations and concrete placement.
 - 1. Support tendons as required to provide profiles shown on installation drawings. Position supports at high and low points and at intervals not exceeding 48 inches (1220 mm). Ensure that tendon profiles between high and low points are smooth parabolic curves.
 - 2. Attach tendons to supporting chairs and reinforcement without damaging tendon sheathing.
 - 3. Support slab tendons independent of beam reinforcement.
- C. Maintain tendon profile within maximum allowable deviations from design profile as follows:
 - 1. 1/4 inch (6.3 mm) for member depth less than or equal to 8 inches (200 mm).
 - 2. 3/8 inch (10 mm) for member depth greater than 8 inches (200 mm) and less than or equal to 24 inches (610 mm).
 - 3. 1/2 inch (13 mm) for member depth greater than 24 inches (610 mm).
- D. Maintain minimum radius of curvature of 480-strand diameters for lateral deviations to avoid openings, ducts, and embedded items. Maintain a minimum of 2 inches (50 mm) of separation between tendons at locations of curvature.
- E. Limit tendon bundles to five tendons. Do not twist or entwine tendons within a bundle. Maintain a minimum distance of 12 inches (300 mm) between center of adjacent bundles.
- F. If tendon locations conflict with non-prestressed reinforcement or embedded items, tendon placement governs unless changes are authorized in writing by Architect. Obtain Architect's approval before relocating tendons or tendon anchorages that interfere with one another.
- G. Deviations in horizontal spacing and location of slab tendons are permitted when required to avoid openings and inserts.
- H. Installation of Anchorage Devices:
 - 1. Place anchorage devices at locations shown on approved installation drawings.
 - 2. Attach pocket formers, intermediate anchorage devices, and stressing-end anchorage devices securely to bulkhead forms. Install stressing-end and intermediate anchorage devices perpendicular to tendon axis.

3. Install tendons straight, without vertical or horizontal curvature, for a minimum of 12 inches (300 mm) behind stressing-end and intermediate anchorages.
 4. Embed intermediate anchorage devices at construction joints in first concrete placed at joint.
 5. Minimum splice length in reinforcing bars at anchorages is 24 inches (600 mm). Stagger splices a minimum of 60 inches (1500 mm).
 6. Place fixed-end anchorage devices in formwork at locations shown on installation drawings. Support anchorages firmly to avoid movement during concrete placement.
- I. Maintain minimum concrete cover as follows:
 1. From Exterior Edge of Concrete to Wedge Cavity: 2 inches (50 mm).
 2. From Exterior Edge of Concrete to Strand Tail: 3/4 inch (19 mm).
 3. Top, Bottom, and Edge Cover for Anchorage Devices: 1-1/2 inches (38 mm).
 - J. Maintain minimum clearance of 6 inches (150 mm) between tendons and openings.
 - K. Prior to concrete placement, mark tendon locations on formwork with spray paint.
 - L. Do not install sleeves within 36 inches (914 mm) of anchorages after tendon layout has been inspected unless authorized in writing by Architect.
 - M. Do not install conduit, pipe, or embeds requiring movement of tendons after tendon layout has been inspected unless authorized in writing by Architect.
 - N. Do not use couplers unless location has been approved by Architect.
 - O. Secure jack pressure plates in position perpendicular to line of stressing force.

3.05 PLACING CONCRETE

- A. Place concrete in accordance with Section 03 3000.
- B. Verify tendons, anchors, seats, plates, and other items to be cast into concrete are placed and secure.
- C. Tolerances:
 1. See Section 03 1000 for formwork construction tolerances.

3.06 TENSIONING

- A. Perform tensioning after concrete has reached 75% of its compressive strength and ambient temperature is above specified requirements, in two steps.
- B. Confirm concrete strength with test cylinders prior to tensioning.
- C. Measure prestressing force. Maintain jacking and tensioning records as work progresses and submit to the engineer within 48 hours.
- D. Jack against tendon pressure plate, not against concrete.
 1. Stress by means of hydraulic jacks equipped with accurate reading calibrated hydraulic pressure gages to permit the stress in a prestressing steel to be computed at all times.
 2. Provide a certified calibration curve with each jack. If inconsistencies occur between the jack gage and the measured elongation, immediately recalibrate the jack gage.
 3. Anchor the prestressing steel at an initial or anchor force of stress that will result in the ultimate retention of the working or effective force or stress shown on the Shop Drawings.
 - a. In no case may the steel be tensioned above 80% of the ultimate strength of the wire, strand, or bars.
 - b. Do not permit the anchor force to exceed 70% of the ultimate strength of the stand.
 4. Do not permit the field readings of elongations and/or stressing forces to vary more than 7% from calculated required values.
 5. Drape to the configuration shown on the Shop Drawings.
 6. Do not permit twisting or entwining of individual wires or strands within a bundle or beam.

- a. Secure the approval of the Architect and governmental agencies having jurisdiction on each item of anchoring, coupling, and miscellaneous hardware.
 - b. Design such items to provide for the full strength of the tendons and also to provide for stressing at the concrete strength shown on the Drawings.
7. Secure the tendons to a sufficient number of positioning devices to assure correct location during and after placement of concrete, but support at a maximum of 4' - 0" on centers.
- E. Stress slab tendons before stressing beam tendons.
- F. Where pockets are required for anchorage, adequately reinforce so as to not decrease the strength of the structure. Except as otherwise approved by the Architect, waterproof the pockets to eliminate leakage of water.
- G. Slight deviations in the spacing of slab tendons will be permitted when required to avoid openings, inserts, and dowels which are specifically located. Where locations of tendons appear to interfere with each other, one tendon may be moved horizontally in order to avoid the interference.
- H. Inserts and sleeves:
1. Use cast-in-place wherever practicable.
 2. Drilled or powder-driven fasteners will be permitted when it can be shown that the inserts will not spall the concrete, and when the inserts are located so as to avoid the tendons and anchorages.
- I. Cut off excess tendon between 1/2" and 3/4" from wedges. Apply touch-up primer to cut end.

3.07 FIELD QUALITY CONTROL

- A. A Special Inspection and Testing Agency (SITA) will perform field quality control tests and inspections, as specified in Sections 01 4516 and 01 4533.

3.08 REMOVAL OF FORMS

- A. See Section 03 1000 for requirements for removal of forms.
- B. Do not remove forms, shores, and bracing until concrete has been tensioned to strength sufficient to carry its own weight, construction loads, and design loads.

3.09 REPAIR OF SURFACE DEFECTS

- A. Repair surface defects in accordance with Section 03 3000.
- B. Request examination of concrete surfaces upon removal of forms.
- C. Modify or repair concrete not complying with required lines, detail, and elevations.
- D. Modify or repair concrete not properly placed, resulting in honeycombing or other defects.

END OF SECTION

**SECTION 03 5200
LIGHTWEIGHT INSULATING CONCRETE**

PART 1 - GENERAL

1.01 SECTION INCLUDES:

- A. Lightweight insulating concrete deck at roof as indicated on the Drawings.
- B. Includes lightweight insulating concrete decks installed on structural steel metal deck and cementitious wood fiber decks.
- C. Provide all materials and accessories required for a complete installation.

1.02 RELATED WORK:

- A. Section 05 3123 - Steel Roof Decking.
- B. Section 06 1000 - Rough Carpentry.
- C. Section 07 5216 - SBS Modified Membrane Roofing
- D. Section 07 7200 - Roof Accessories.

1.03 SUBMITTALS

- A. Review and comply with all provisions of section 01 3300 — Submittals.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
 - 1. Mix Design: Indicate materials, thermal values, product limitations and proportions of proposed mix.
 - 2. Manufacturer's letter of certification of the approved installer.
 - 3. Material test reports from a qualified independent testing agency evidencing compliance with requirements of the following based on comprehensive testing of current materials: cement, aggregates, foaming agents, admixtures and molded insulation.
 - 4. Material certificates in lieu of agency test reports, when permitted by Architect and Owner's Roofing Consultant, signed by lightweight insulating concrete manufacturer certifying that each materials item complies with requirements.
- C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 1. Show profiles, sizes, spacing and locations of assembled components.02 Show details of shop fabrications, connections and details.
 - 2. Show details of shop fabrications, connections and details.
 - 3. Show details of field fabrications, connections and details.
 - 4. Show plans, sections and details of roof slopes, insulation thickness, roof penetrations, roof perimeter terminations and curbs, control and expansions joints and roof drains.
 - 5. Provide calculations demonstrating compliance with wind load and other requirements.
 - 6. Shop drawings shall be sealed and signed by a Texas registered engineer.
- D. Installation Instructions: Submit manufacturer's complete installation instructions,
 - 1. Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 2. Generic details that do not depict actual conditions shall not be acceptable.
- E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 1. Include recommended cleaning products and instructions for use.
 - 2. Where applicable, provide recommended maintenance schedules and procedures.

- F. Design mixes for lightweight insulating concrete mix, including as—cast unit weight— dry unit weight and compressive strength.
- G. Manufacturer's specifications and other data for all products proposed to be furnished as needed to prove compliance with specified requirements.
- H. Manufacturer's letter of certification of the approved installer.

1.04 REFERENCES

- A. American Society for Testing and Material:
 - 1. ASTM C150 — Standard Specifications for Portland Cement.
 - 2. ASTM C177 — Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by means of the Guarded- Hot-Plate apparatus.
 - 4. ASTM C332 — Standard Specification for Lightweight Aggregates for Insulating Concrete, Group 1.
 - 5. ASTM C495 — Standard Test Method for Compressive Strength of Lightweight Insulating Concrete.
 - 6. ASTM C513 — Standard Test Method for obtaining Specimens of Hardened Lightweight Insulating Concrete for Compressive Strength.
 - 7. ASTM C578 — Standard Specifications for Rigid Cellular Polystyrene Thermal Insulation.
 - 8. ASTM C796 — Standard Test Method for Foaming Agents for Use in Producing Cellular Concrete Using Preformed Foam.
 - 9. ASTM C869, Standard Specifications for Foaming Agents Used in Making Preformed Foam for Cellular Concrete.
 - 10. ASTM C1077 — Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation.
 - 11. ASTM E119 — Standard Test Method for Fire Tests of Building Construction and Materials.
 - 12. ASTM E329 — Standard Specifications for Agencies Engaged in Construction Inspection, Testing and Special Inspection.
- B. Comply with all applicable recommendations of American National Standard Institute (ANSI) A122.1, and any others referred to herein. In any conflict between referenced standards, the more stringent requirements shall govern.
 - 1. ANSI / SPRI FX-1-2006 — Standard Field Test Procedures for Determining the Withdrawal Resistance of Roofing Fasteners.
- C. National Roofing Contractors Association (NRCA)

1.05 QUALITY ASSURANCE AND TESTING PROCEDURES

- A. Acceptable Applicators:
 - 1. Applicator must be approved / licensed by the system manufacturer. Approval shall be confirmed in writing to the Architect. Written approval by the manufacturer for the applicator shall include the project by name.
 - 2. Applicator must have at least five (5) years of satisfactory experience installing the specified system.
 - 3. Upon request by the Architect, provide a list of at three (3) projects where the applicator has installed the specified / proposed lightweight insulating concrete deck. List shall include the name and contact information of the project architect and general contractor.
- B. Testing Laboratory Services:
 - 1. The Owner will select the Testing Laboratory and pay for the cost of tests to determine the dry density and compressive strength of the lightweight insulating concrete deck. Testing shall be determined in accordance with ASTM C495.
- C. Quality Assurance:

1. The system shall conform to the requirements of FM Global and shall be currently listed as an approved component in the FM RoofNav Database.
 2. Roof Deck assembly shall conform to F.M. wind uplift Class 90.
 3. The system manufacturer's product shall be UL classified and listed in the current Underwriters Laboratories "Fire Resistance Design Directory".
- D. Provide lightweight aggregates containing no detectable asbestos as determined by the method specified in EPA's 40 CFR Part 763, Subpart F, Appendix A, Section 1 "Polarized Light Microscopy".
- E. Building / Construction Components:
1. Meet or exceed established standards.

1.06 ROOF SYSTEM COORDINATION

- A. Coordinate with roofing manufacturer / contractor as required to assure compatibility of the lightweight insulating roof deck with the performance and installation criteria of the specified basis of design roofing system.
- B. If a roofing system other than the basis of design system is used on the project, coordinate as required to assure compatibility of the light-weight insulating roof deck with the performance and installation criteria of the roofing system.
- C. Modify the design performance of the lightweight insulating roof deck as required to meet requirements of the roofing system to be installed.

1.07 WARRANTY

- A. Shall be covered under the Roofing Manufacturer's 20-year warranty. Refer to section 07 5216. Warranty shall be all inclusive for full roof system.
- B. Provide manufacturer's unlimited warranty on the lightweight concrete roof deck as follows.
 1. The actual resistance to heat flow through the roof insulation shall be at least eighty percent (80%) of design thermal resistance, provided that the roofing membrane is maintained free of leaks.
 2. Should leak occur, the insulating performance of the roof insulation will be equal to that described in item 1 above within a two (2) year period following the leak.
 3. The roof insulation will remain in a re-roof compatible condition should the roof membrane require replacement. Damage to the roof insulation caused by fastener pullout during removal of the old membrane is excluded.
 4. The roof insulation will not cause structural damage to the building as a result of its expansion from thermal or chemical action. Replacement of the roof membrane will not be included.
- C. This warranty shall cover materials and labor for the replacement of defective work and may not be limited by penal sum.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. The design of Lightweight Insulating Concrete is based on systems / products manufactured and supplied by Siplast

2.02 SYSTEM DESCRIPTION

- A. Lightweight Concrete System Description: Provide materials used in the lightweight concrete roof insulation system conforming to the following.
 1. Galvanized Metal Deck: Corrugated steel decking incorporating a pre-applied galvanized coating conforming to a minimum Class G-60 as specified in ASTM A 525 and having slots in the flutes equal to a minimum of 0.5% of the deck area. Refer to general notes on the structural drawings and Specification Section 05300 for metal deck specifications and attachment requirements.

2. Portland Cement: Portland cement conforming to Type I, II, or III as defined by ASTM C 150.
 3. Foam Concentrate: Protein based foam concentrate conforming to ASTM C 869 and ASTM C 796.
 - a. Insulcel PB Foam Concentrate by Siplast, Inc., Irving, TX
 4. Expanded Polystyrene Insulation Board: Expanded polystyrene (EPS) insulation board having a nominal density of 1 pcf (16 kg/m³) defined as Type I by ASTM C 578 and containing approximately 3% open area. Each bundle of board shall be delivered to the job site with clear identification as to manufacturer and shall carry the Factory Mutual approval label and the Underwriter's Laboratories Classified label on each bundle.
 - a. Insulperm Insulation Board by Siplast, Inc., Irving, TX
 5. Water: Potable water that is clean and free of deleterious amounts of acid, alkali and organic materials.
 6. Reinforcing Fibers: polypropylene fibers, "Fibermix" as manufactured by Fibermesh Co. or approved equal.
 7. Acoustic Metal Deck: Verify mix design for proper curing with acoustic deck manufacturer.
- B. Expansion Joint Material: 1" thick asphalt-impregnated board approved by the manufacturer for use in conjunction with and insulating concrete deck.

2.03 MIX DESIGN

- A. Density: Mix Portland cement and pre-generated foam with water to achieve a wet density of 40 pcf, resulting in a minimum dry density of 34 pcf and minimum compressive strength of 300 psi (2068 kPa).

2.04 INSULATION BOARD

- A. To be used with the lightweight insulating concrete mix.
- B. Expanded polystyrene insulation board having a nominal density of one (1) pcf and defined as type I by ASTM C578.
- C. Thickness: six (6) inches minimum to achieve an R-value of R-25 minimum.
- D. Fire Resistance: Flame spread— ASTM E84. Smoke Density— ASTM E84.
- E. Provide approximately three percent (3%) open area.
- F. Approved product: Insulperm Insulation Board

2.05 DESIGN OF ROOF DRAINAGE

- A. The design to drain roof areas, whether to roof drains or gutters, is generally accomplished by sloping the underlying steel structure sloping to the drainage vehicle.
- B. In areas of the roof that are shown to be crickets or similar, provide tapered rigid insulation or build up surface of lightweight concrete above the EPS insulation in the patterns shown or required to facilitate full drainage of the roof surface.
 1. Area to slope at 1/4" per foot unless noted otherwise.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

- A. Prior to erection of forms, inspect structural deck to ensure all work is complete and suitable for this installation to progress.
- B. Prior to placing insulating concrete, inspect metal forms to ensure that they are secured to the structure and free of debris or foreign materials.
- C. Verify that all deficiencies have been corrected prior to commencing installation.
- D. Weather:
 1. Insulating concrete roof decks may be placed when temperatures are 40°F and rising.

2. If colder temperatures are anticipated, the Applicator shall take suitable precautions for the installation of an acceptable deck.
 3. Do not place insulating concrete deck during precipitation or when there is a likely expectation that precipitation will occur during installation.
 4. Adverse weather precautions, actions and remedies shall be in strict accordance with the system manufacturer's standards and recommendations.
- E. Remove water and other substances that would interfere with bonding or curing of the lightweight insulating concrete system.
- F. The roofing membrane system application must be coordinated with the insulating concrete installation to avoid prolonged exposure of the roof deck.
- G. Do not begin placement of the lightweight insulating concrete system until the Architect's Representative, Owner's Roofing Consultant, General Contractor and the Insulation System Applicator have examined surfaces to receive the roof insulation and determine that the surface or surfaces are acceptable. Protect permanently exposed walls, floors or special surfaces while placing insulating concrete.

3.02 INSTALLATION

- A. Lightweight concrete shall be mixed in accordance with manufacturer's standards and recommendations, using equipment and procedures to avoid segregation of mix and loss of air content.
- B. Install expansion joint material at the following locations. Material shall extend full depth of insulating lightweight concrete.
- C. Structural roof penetrations
1. Expansion joints
 2. Junctures with vertical surfaces, including curbs, walls and vents
- D. Reinforcing: in the mixing bin, add two (2) pounds of fiber reinforcing per cubic yard of insulating concrete fill, for all light weight concrete.
- E. Fill valleys / voids of structural metal deck with a leveling thickness of lightweight concrete fill.
- F. Install EPS rigid insulation board in the fresh bond coat of lightweight concrete fill.
1. Install slurry coat of lightweight insulating concrete over metal deck to minimum thickness of $\frac{1}{4}$ inch over top of flutes of metal decking.
 2. Place insulation boards into slurry coat within 30 minutes of applying lightweight insulating concrete in accordance with manufacturer's instructions.
 3. Install insulation board in fresh bond coat layer in such a manner that results in the underside of insulation boards making full coverage contact with bond coat layer. Stagger joints and tightly butt insulation boards as directed by manufacturer.
 4. Walk board into slurry to ensure proper embedding of insulation boards into lightweight insulating concrete and keying with insulation holes. Do not slide boards across slurry coat.
- G. Install a minimum of 2" thickness of lightweight concrete fill over EPS board, filling all bond holes, perimeter voids and other locations to produce a smooth surface suitable for the installation of the specified roofing system.
1. The surface to receive lightweight concrete fill shall be dry, free of water, dew, frost, ice and snow at the time of placement.
- H. Where indicated on the drawings increase depth of lightweight concrete fill as required to form crickets, etc. required for positive drainage.
- I. Insulating concrete shall be screeded to the proper thickness and slope with a surface free of ridges and sharp projections prior to installation of the roofing membrane.
- J. Cure roof deck topping in accordance with the system manufacturer's standards and recommendations.

- K. Avoid roof-top traffic over the lightweight insulating concrete deck system until 24 hours have elapsed after last placement of lightweight insulating concrete or as instructed by manufacturer, whichever is greater.

3.03 FIELD QUALITY CONTROL AND TESTING

- A. The Owner will select the independent testing laboratory and pay for the cost of tests in accordance with Division 1.
- B. The independent testing laboratory will randomly sample and verify the following:
 - 1. Thermal insulation value in accordance with ASTM C177.
 - 2. Mix design compressive strength in accordance with ASTM C495.
 - 3. Mix design wet and dry density range in accordance with ASTM C495.
 - 4. Polystyrene insulation density in accordance with ASTM C578.
 - 5. Base ply fastener pull tests three (3) days or more following the installation of the lightweight insulating concrete to ensure a minimum withdrawal resistance of 40 pounds per fastener.
- C. Additional Tests: Make additional tests when test results indicate as-cast unit weight, compressive strength, oven dry unit weight, or other requirements have not been met. All retesting shall be at the expense of the Contractor.
- D. Retest in-place lightweight insulating concrete according to ASTM C513 for compressive strength and oven-dry unit weight
- E. Retests for work which fail initial tests or inspections shall be paid by contractor.
- F. Results of all tests will be made available to all concerned parties within 24 hours of completion of each test.
- G. Water Test: Run water on the finished deck for the Architect's observation. The lightweight insulating concrete shall slope to drain and no ponding of water will be accepted. Also, no slopes less than 1/8 inch per foot will be allowed.
- H. Certification: On completion of installation, furnish Architect with certificate signed by a representative of the manufacturer and by the applicator stating that insulating concrete was prepared and applied in accordance with manufacturer's recommendation.

3.04 COORDINATION WITH ROOFING WORK

- A. Confirm prior to placement of the lightweight concrete that the specified roof system is compatible with the type of insulating concrete to be installed.
- B. Begin roofing when the insulating concrete roof deck has open air cured sufficiently to a point where subsequent work can progress without damage to the lightweight insulating concrete deck.
 - 1. This is usually 3 to 5 days after the deck has been placed.
 - 2. Confirm the Contractor has coordinated with roofing installer as required.
- C. The roof deck should not be left exposed for longer than 5 to 7 days following open-air cure period.
- D. Consult the roofing manufacturers for their recommended attachment of the roofing system to the insulating concrete roof deck system.

3.05 CLEANING

- A. Remove visible lightweight insulating concrete from underside of metal deck where it is exposed to normal view.
- B. Wash floors below the lightweight insulating concrete deck system after each day's installation or as necessary and remove wash water.

3.06 REPAIRS

- A. Where required to provide surface conditions suitable to receive the specified roof system, repairs to smooth the deck surface, correct depressions or fill divots shall be performed in accordance with written guidance provided by the systems manufacturer.
- B. Remove and replace any area of the roof deck that fails to comply with the requirements of the systems manufacturer, this specification or applicable product approval.

3.07 PROTECTION

- A. General Contractor shall be responsible for protection of roof deck from other trades until it has been approved for traffic by installer.
- B. No storage of materials shall be permitted on the new roof areas other than those materials that are to be installed the same day. In no case shall material be stored on the existing roof. Any exception must be in written form.

END OF SECTION

**SECTION 04 0100
MAINTENANCE OF MASONRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Final cleaning of masonry surfaces.
- B. Replacement of masonry units.
- C. Repointing mortar joints.
- D. Repair of damaged masonry.

1.02 RELATED REQUIREMENTS

- A. Section 04 0511 - Masonry Mortaring and Grouting.
- B. Section 04 2000 - Unit Masonry: Brick and Block masonry units.
- C. Section 04 4313 - Stone Masonry Veneer.

1.03 REFERENCE STANDARDS

- A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week prior to commencing work of this section.
 - 1. Require attendance of parties directly affecting work of this section.
 - 2. Review conditions of installation, installation procedures, and coordination with related work.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on cleaning compounds and cleaning solutions.
 - 1. Cleaning Plan: Written description of cleaning process, including materials, methods, equipment, and sequencing of work.
- C. Applicator Qualifications: Submit qualifications of applicator.
 - 1. Certification stating applicator is experienced in the application of the specified products.
 - 2. List of recently completed masonry cleaning projects, including project name and location, names of owner and architect, description of cleaning products used and substrates, applicable local environmental regulations, and application procedures.
- D. Environmental Regulations: Submit description for testing, handling, treatment, containment, collection, transport, disposal, and discharge of hazardous wastes and cleaning effluents. Describe any hazardous materials to be cleaned from substrates. Submit applicable local environmental regulations.
- E. Protection: Submit description for protecting surrounding areas, landscaping, building occupants, pedestrians, vehicles, and non-masonry surfaces during the work from contact with masonry cleaners, residues, rinse water, fumes, wastes, and cleaning effluents.
- F. Surface Preparation: Submit description for surface preparation of substrates to be completed before application of masonry cleaners.
- G. Application: Submit description for application procedures of masonry cleaners.

1.06 QUALITY ASSURANCE

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
- B. Manufacturer Qualifications:

1. Manufacturer capable of providing field service representation during installation and who will approve the installer and application method.
- C. Installer Qualifications:
 1. Installer experienced in performing this type of work and who has specialized in work similar to the type required for this project.
- D. Pre-installation Meetings
 1. Comply with provisions of Section 01 3000 - Administrative Requirements.
 - a. Applicator and Product representative shall be present during meeting.

1.07 MOCK-UP

- A. Test Panels:
 1. Before full-scale application, test products to be used on test panels.
 2. Review manufacturer's product data sheets to determine suitability of each product for each surface.
 3. Apply products using manufacturer-approved application methods, determining actual requirements for application.
 4. After 48 hours, review effectiveness of cleaning or treatment, compatibility with substrates, and ability to achieve desired results.
 5. Obtain approval by Architect and Owner of workmanship, color, and texture before proceeding with work.
 6. Test Panels: Inconspicuous sections of actual construction.
 - a. Location and number as selected by Architect.
 - b. Size; 4 feet by 4 feet.
 - c. Repair unacceptable work to the satisfaction of the Architect and Owner.
- B. Acceptable panel and procedures employed will become the standard for work of this section.
- C. Mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver masonry neatly stacked and tied on pallets. Store clear of ground with adequate waterproof covering.
- B. Store cleaning materials in manufacturer's packaging.

1.09 FIELD CONDITIONS

- A. Do not apply products under conditions outside manufacturer's requirements, which include:
 1. Surfaces that are frozen; allow complete thawing prior to installation.
 2. Surface and air temperatures below 40 degrees F.
 3. Surface and air temperatures above 95 degrees F.
 4. When surface or air temperature is not expected to remain above 40 degrees F for at least 8 hours after application.
 5. Wind conditions that may blow materials onto surfaces not intended to be treated.
 6. Less than 24 hours after a rain or 6 hours before rain is expected after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Restoration and Cleaning Chemicals:
 1. Diedrich Technologies, Inc: www.diedrichtechnologies.com/#sle.
 2. PROSOCO: www.prosoco.com.
 3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 CLEANING MATERIALS

- A. Water: Clean, potable, and free of oils, acids, alkalis, salts, and organic matter. Use to rinse masonry surfaces and dilute concentrated cleaners.
-

- B. Cleaning Agent: Product types listed are manufactured by Prosoco, inc. as basis of design.

MATERIAL	COLOR/TEXTURE	CLEANER
Brick	Red	600 Detergent
	Light	Vana Trol
	Dark	Vana Trol
	Pavers	600 Detergent
	Glazed	Vana Trol
CMU	Split Face	Custom Masonry Cleaner
	Burnished/Ground Face	Light Duty Concrete Cleaner
Cast Stone	Integral Color	Light Duty Concrete Cleaner
Architectural Concrete	Natural Color	Light Duty Concrete Cleaner
	Textured	Heavy Duty Concrete Cleaner

2.03 MORTAR MATERIALS

- A. Comply with requirements of Section 04 0511.

2.04 MASONRY MATERIALS

- A. Unit Masonry: Section 04 2000.
 B. Cast Stone Masonry: Section 04 7200
 C. Stone Veneer: Section 04 4313.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces to be cleaned and restored are ready for work of this section.
 B. Do not begin until test panels have been approved by Architect.

3.02 PREPARATION

- A. Protect surrounding elements from damage due to restoration procedures.
 B. Carefully remove and store removable items located in areas to be restored, including fixtures, fittings, finish hardware, and accessories; reinstall upon completion.
 C. Separate areas to be protected from restoration areas using means adequate to prevent damage.
 D. Cover existing landscaping with tarpaulins or similar covers.
 E. Mask immediately adjacent surfaces with material that will withstand cleaning and restoration procedures.
 F. Close off adjacent occupied areas with dust proof and weatherproof partitions.
 G. Protect roof membrane and flashings from damage with 1/2 inch plywood laid on roof surfaces over full extent of work area .
 H. When using cleaning methods that involve water or other liquids, install drainage devices to prevent runoff over adjacent surfaces unless those surfaces are impervious to damage from runoff.
 I. Do not allow cleaning runoff to drain into sanitary or storm sewers.

3.03 REBUILDING

- A. Cut out damaged and deteriorated masonry with care in a manner to prevent damage to any adjacent remaining materials.

- B. Support structure as necessary in advance of cutting out units.
- C. Cut away loose or unsound adjoining masonry and mortar to provide firm and solid bearing for new work.
- D. Build in new units following procedures for new work specified in other section(s).
- E. Mortar Mix: Colored and proportioned to match existing work.
- F. Ensure that anchors, ties, reinforcing, and flashings are correctly located and built in.
- G. Install built in masonry work to match and align with existing, with joints and coursing true and level, faces plumb and in line. Build in all openings, accessories and fittings.

3.04 REPOINTING

- A. Perform repointing prior to cleaning masonry surfaces.
- B. Cut out loose or disintegrated mortar in joints to minimum 1/2 inch depth or until sound mortar is reached.
- C. Use power tools only after test cuts determine no damage to masonry units will result.
- D. Do not damage masonry units.
- E. When cutting is complete, remove dust and loose material by brushing.
- F. Premoisten joint and apply mortar. Pack tightly in maximum 1/4 inch layers. Form a smooth, compact concave joint to match existing.
- G. Moist cure for 72 hours.

3.05 CLEANING OF MASONRY

- A. Comply with provisions of Section 01 7000 - Execution and Closeout Requirements.
- B. Clean all exposed surfaces of new masonry of excess mortar, efflorescence, stains, and job dirt, using materials specified.
- C. Clean from top down; prevent cleaning materials and rinse water from contacting non-cementitious materials.
- D. Clean in accordance with manufacturer's instructions and recommendations, product data, and container label instructions.
- E. Mix materials in strict accordance with manufacturer's instructions; do not dilute unless permitted by manufacturer.
- F. Prevent overspray, wind drift, and splash onto surfaces not to be treated.
- G. No high pressure washers are allowed.
- H. Low pressure spray for wetting and rinsing is permitted. Pressure should be in the range of 400-700 psi. Equipment should produce 4-6 gallons of water per minute using a 15-40 degree fan tip (no fan tip less than a 15-degree is allowed).

3.06 AGING

- A. Rub in new masonry work to match, as close as possible, adjacent original work.
 - 1. Use carbon black in small amounts, rubbing in well with burlap rags.
- B. After each application, dust off surplus and wash down with low pressure hose. Allow surface to dry before proceeding with succeeding applications.
- C. Continue process until acceptance.

3.07 FIELD QUALITY CONTROL

- A. Inspection:

1. Inspect the masonry cleaning work with the Contractor, Architect, applicator, and product representative, and compare with test panel results approved by the Architect. Determine if the substrates are suitably clean.
- B. Manufacturers' Field Services
 1. Provide the services of the manufacturer's authorized field representative to verify that installed products comply with manufacturer's requirements and with the standard established by the Architect-approved test panels.

3.08 CLEANING

- A. Immediately remove stains, efflorescence, or other excess resulting from the work of this section.
- B. Remove excess mortar, smears, and droppings as work proceeds and upon completion.
- C. Clean surrounding surfaces.
- D. Repair, restore, or replace to the satisfaction of the Architect, all materials, landscaping, and non-masonry surfaces damaged by exposure to the cleaning process.

END OF SECTION

**SECTION 04 0511
MASONRY MORTARING AND GROUTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Mortar for masonry.
- B. Grout for masonry.

1.02 RELATED REQUIREMENTS

- A. Section 04 0100 - Maintenance of Masonry: Bedding and pointing mortar for masonry restoration work.
- B. Section 04 2000 - Unit Masonry: Installation of mortar and grout.

1.03 REFERENCE STANDARDS

- A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.
- B. ASTM C5 - Standard Specification for Quicklime for Structural Purposes; 2010.
- C. ASTM C91/C91M - Standard Specification for Masonry Cement; 2018.
- D. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2023.
- E. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.
- F. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.
- G. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.
- H. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.
- I. ASTM C387/C387M - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar; 2015.
- J. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2018.
- K. ASTM C476 - Standard Specification for Grout for Masonry; 2019.
- L. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2020.
- M. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.
- N. ASTM C1019 - Standard Test Method for Sampling and Testing Grout; 2016.
- O. ASTM C1072 - Standard Test Method for Measurement of Masonry Flexural Bond Strength; 2013, with Editorial Revision (2014).
- P. ASTM C1148 - Standard Test Method for Measuring the Drying Shrinkage of Masonry Mortar; 1992a (Reapproved 2014).
- Q. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2016.
- R. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry; 2014a.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include design mix and indicate whether the Proportion or Property specification of ASTM C270 is to be used.
 - 1. Where a water repellent admixture is specified, submit documentation showing that water repellent admixture is compatible with the water repellent used by the masonry brick/block manufacturer.

- C. Samples: Submit two samples of mortar, illustrating mortar color and color range.
- D. Reports: Submit reports on mortar indicating compliance of mortar to property requirements of ASTM C270 and test and evaluation reports per ASTM C780.
- E. Reports: Submit reports on grout indicating conformance of component grout materials to requirements of ASTM C476 and test and evaluation reports to requirements of ASTM C1019 and ASTM C939.
- F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- G. Manufacturer's Installation Instructions: Submit packaged dry mortar manufacturer's installation instructions, if packaged dry mortars are used.

1.05 QUALITY ASSURANCE

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
 - 1. Maintain one copy of each document on project site.

1.06 PRECONSTRUCTION TESTING

- A. Testing will be conducted by an independent test agency, in accordance with provisions of Section 01 4000 - Quality Requirements.
- B. Mortar Mixes: Test mortars prebatched by weight in accordance with ASTM C780 recommendations for preconstruction testing.
 - 1. Test results will be used to establish optimum mortar proportions and establish quality control values for construction testing.
- C. Grout Mixes: Test grout batches in accordance with ASTM C1019 procedures.
 - 1. Test results will be used to establish optimum grout proportions and establish quality control values for construction testing.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.08 FIELD CONDITIONS

- A. Temperature and Humidity
 - 1. During cold weather construction do not lay masonry units unless the temperature is 40 degrees Fahrenheit and rising.
 - 2. During hot weather construction (ambient air temperature exceeds 100 degrees Fahrenheit or 90 degrees Fahrenheit with wind velocity greater than 8 mph) do not spread mortar beds more than 4 feet ahead of masonry and set brick masonry within 1 minute of spreading mortar. Fog spray cure twice daily at four hour intervals for three days during hot weather.
 - 3. Protect masonry construction from direct exposure to wind and sun when erected in ambient air temperature of greater than 99 degrees Fahrenheit in the shade, with relative humidity less than 50 percent.
 - 4. During hot weather protect brick masonry units from sun until units are ready to be placed in the wall.

PART 2 PRODUCTS

2.01 MORTAR AND GROUT APPLICATIONS

- A. At Contractor's option, mortar and grout may be field-mixed from packaged dry materials or made from factory premixed dry materials with addition of water only.
- B. Mortar Color: Natural gray unless otherwise indicated.

1. Where colored mortar is specified it is recommended that factory premixed mortar be used. Mortar color shall be consistent throughout the project with the sample produced and approved on the mock-up wall.
- C. Mortar Mix Designs: ASTM C270, Proportion Specification.
1. Masonry below grade and in contact with earth: Type S.
 2. Exterior Masonry Veneer: Type N.
 3. Exterior, Loadbearing Masonry: Type N.
 4. Exterior, Non-loadbearing Masonry: Type N.
 5. Exterior Repointing Mortar: Type N with maximum 2 percent ammonium stearate or calcium stearate per cement weight.
 6. Interior, Loadbearing Masonry: Type N.
 7. Interior, Non-loadbearing Masonry: Type N.
 8. Pointing Mortar for Prefaced or Specially Faced Unit Masonry: One part Portland cement, 1/8 part hydrated lime, and two parts graded (80 mesh) aggregate, proportioned by volume. Add aluminum tristearate, calcium stearate, or ammonium stearate equal to 2 percent of Portland cement by weight.
 9. Glass Unit Masonry: Type N mortar and Type O pointing mortar.
- D. Grout Mix Designs:
1. Refer to Contract Documents for grout strength and slump requirements. Provide premixed or job mixed grout in accordance with ASTM C94/C94M. It is permitted to provide fine or coarse grout in accordance with the table below:

Grout Type	Maximum Grout Pour Height	Minimum Clear Width of Grout Space	Minimum Clear Grout Space Dimensions for Grouting Cells of Hollow Units
Fine	1'-0"	3/4"	1 1/2" x 2"
	5'-0"	2"	2" x 3"
	12'-0"	2 1/2"	2 1/2" x 3"
	24'-0"	3"	3" x 3"
Coarse	1'-0"	1 1/2"	1 1/2" x 3"
	5'-0"	2"	2 1/2" x 3"
	12'-0"	2 1/2"	3" x 3"
	24'-0"	3"	3" x 4"

2. Grout shall be poured in maximum lift heights (increment of grout height within a pour height) and maximum grout heights (total height of masonry to be poured prior to the erection of additional masonry) noted below:
 - a. Grout in partially grouted walls shall be placed in pour heights equal to the bond beam spacing not to exceed 5'-4". Pour heights are permitted to be increased up to 12'-8" provided the following conditions are met:
 - 1) The masonry has cured for a minimum of 4 hours.
 - 2) Grout slump is maintained between 10 in and 11 in.
 - 3) No intermediate reinforced bond beams are placed between the top and the bottom of the pour height.
 - b. Grout in fully grouted walls are permitted to be poured per the maximum pour heights provided in the table above. Lift heights shall not exceed 5'-4" except that it permitted to increase lift heights to 12'-8" provided the following conditions are met:
 - 1) The masonry has cured for a minimum of 4 hours.
 - 2) Grout slump is maintained between 10 in and 11 in.
 - c. Grout in lintel beams shall be placed in lift heights equal to the full depth of the beam unless noted otherwise.

2.02 MATERIALS

- A. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C387/C387M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
 - 1. Color: Mineral pigments added as required to produce approved color sample.
- B. Packaged Dry Material for Grout for Masonry: Premixed cementitious materials and dried aggregates; capable of producing grout of the specified strength in accordance with ASTM C476 with the addition of water only.
- C. Portland Cement: ASTM C150/C150M.
 - 1. Type: Type I - Normal; ASTM C150/C150M.
 - 2. Color: Color as required to produce approved color sample.
- D. Masonry Cement: ASTM C91/C91M.
 - 1. Type: Type N; ASTM C91/C91M.
- E. Hydrated Lime: ASTM C207, Type S.
- F. Quicklime: ASTM C5, non-hydraulic type.
- G. Mortar Aggregate: ASTM C144.
- H. Grout Aggregate: ASTM C404.
- I. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
 - 1. Pigment:
 - a. Face Brick: Natural Gray
 - b. Brick Pool Coping: Match Brick
 - c. Architectural CMU: Match Unit
 - d. Cast Stone/CSMU: Match Unit
 - e. Existing Construction: Match existing mortar color.
 - 2. Manufacturers:
 - a. Quikrete Companies: www.quikrete.com
 - b. Amerimix, an Oldcastle brand, Bonsal American: www.amerimix.com
 - c. TXI: www.txi.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- J. Water: Clean and free from deleterious acids, alkalis, and organic matter.
- K. Integral Water Repellent Admixture: Polymeric liquid or powder admixture added to mortar at the time of manufacture.
 - 1. Performance of Mortar with Integral Water Repellent:
 - a. Water Permeance: When tested per ASTM E514/E514M and for a minimum of 72 hours:
 - 1) No water visible on back of wall above flashing at the end of 24 hours.
 - 2) No flow of water from flashing equal to or greater than 0.032 gallons per hour at the end of 24 hours.
 - 3) No more than 25 percent of wall area above flashing visibly damp at end of test.
 - b. Flexural Bond Strength: ASTM C1072; minimum 10 percent increase.
 - c. Compressive Strength: ASTM C1314; maximum 5 percent decrease.
 - d. Drying Shrinkage: ASTM C1148; maximum 5 percent increase in shrinkage.
 - 2. Required only at all single wythe exterior masonry wall applications and in conjunction with hollow brick used on the back of parapet walls.
 - 3. At single wythe exterior concrete masonry, water repellent admixture shall be compatible with the water repellent used by the masonry unit manufacturer.

2.03 MORTAR MIXING

- A. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.
- B. Maintain sand uniformly damp immediately before the mixing process.
- C. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio; mix in accordance with manufacturer's instructions, uniform in coloration.
- D. No Admixtures are allowed except water repellents where required.
- E. Do not use anti-freeze compounds to lower the freezing point of mortar.
- F. If water is lost by evaporation, re-temper only within two hours of mixing.

2.04 GROUT MIXING

- A. Mix grout in accordance with ASTM C94/C94M.
- B. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.
- C. No Admixtures are allowed except water repellents where required.
- D. Do not use anti-freeze compounds to lower the freezing point of grout.

PART 3 EXECUTION

3.01 PREPARATION

- A. Plug clean-out holes for grouted masonry with matching masonry units. Brace masonry to resist wet grout pressure.

3.02 INSTALLATION

- A. Contractor shall note that the dimensions shown on the floor plans and plan details are in some instances nominal masonry dimensions. The contractor is responsible for coordinating the masonry layout to provide 3/8" joints. If conflict occurs, contractor shall contact Architect prior to installing masonry.
- B. Site Verification of Conditions
 - 1. Examine the area and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.
 - 2. Verify that wall ties, and reinforcement are properly located.
 - 3. Verify that flashings are properly located and intact.
- C. Mortar and Grout
 - 1. Head joints: Regardless of thickness, completely fill with mortar or grout. Do not slush full.
 - 2. Except at the finishing course, stop grout approximately 1" below the top of the last course.
 - 3. At the finishing course, bring the last grout pour flush with the top of the brick.
 - 4. Whenever possible, grout from the inside face of the masonry.
 - 5. Take extreme care to prevent grout or mortar staining the face of masonry to be left exposed or unpainted.
 - 6. Protect sills, ledges, offsets, door jambs, corners, and similar points from damage and from collecting mortar or grout.
 - 7. Immediately remove mortar and grout from areas where they are not scheduled to be placed.
 - 8. All mortar shall be hard and durable after curing. Scratchable mortar is not acceptable.
 - 9. Perform grouting in strict accordance with the provisions of the Building Code.
 - 10. Solidly fill vertical cells containing reinforcement.

11. Consolidate grout at time of pour by puddling with a mechanical vibrator, filling all cells of the masonry, and then reconsolidating later by puddling before the plasticity is lost.
- D. Install mortar and grout to requirements of section(s) in which masonry is specified.
- E. Work grout into masonry cores and cavities to eliminate voids.
- F. Do not install grout in lifts greater than 16 inches without consolidating grout by rodding.
- G. Do not displace reinforcement while placing grout.
- H. Remove excess mortar from grout spaces.

3.03 FIELD QUALITY CONTROL

- A. A Special Inspection and Testing Agency (SITA) will perform field quality control tests and inspections, as specified in Sections 01 4516 and 01 4533.

END OF SECTION

**SECTION 04 2000
UNIT MASONRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Standard Concrete Masonry Units.
- B. Clay facing brick.
- C. Reinforcement and anchorage.
- D. Flashings.
- E. Lintels.
- F. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 2000 - Concrete Reinforcing: Reinforcing steel for grouted masonry.
- B. Section 04 0100 - Maintenance of Masonry.
- C. Section 04 0511 - Masonry Mortaring and Grouting.
- D. Section 05 5000 - Metal Fabrications: fabricated steel items.
- E. Section 06 1000 - Rough Carpentry: Nailing strips built into masonry.
- F. Section 07 2100 - Thermal Insulation: Insulation for cavity spaces.
- G. Section 07 2500 - Weather Barriers: Water-resistive barriers or air barriers applied to the exterior face of the backing sheathing or masonry.
- H. Section 07 6200 - Sheet Metal Flashing and Trim: Metal through-wall masonry flashings.
- I. Section 07 8400 - Firestopping: Firestopping at penetrations of fire-rated masonry and at top of fire-rated walls.
- J. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

- A. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2016a.
- B. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale); 2017a.
- C. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls; 2017.
- D. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.
- E. NCMA TEK 19-7 - Characteristics of Concrete Masonry Units with Integral Water Repellent, 2008
- F. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meetings
 - 1. Comply with provisions of Section 01 3000 - Administrative Requirements.
 - 2. Not less than one week prior to commencing all masonry related items a pre-installation conference shall be held at the site. Attendance is mandatory for all trades affected by this section. The general contractor shall be responsible for coordinating this conference with all affected trades (Including but not limited to jobsite superintendent, masonry contractor, masonry foreman, waterproofing and flashing contractor, concrete block insulator and architect). The architect will conduct the business of this meeting. All masonry work that takes place prior to this conference shall be marked as rejected and shall be removed, no exceptions.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
- C. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, masonry reinforcement, size and type of fasteners, and accessories for brick/blockwork support system.
- D. Samples: Submit four samples of facing brick and architectural masonry units to illustrate color, texture, and extremes of color range. Sample shall be of actual unit specified to be installed.
- E. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
 - 1. Maintain one copy of each document on project site.
- B. At all units (concrete masonry, stone, cast stone or other) for which an integral water repellent was specified to be in the units, perform the Water Droplet Test as recommended in the performance criteria of NCMA TEK 19-7 associated with the Water Droplet Test Method.
- C. Certifications
 - 1. Do not commence placement of masonry until mortar mix designs have been reviewed and approved by the Testing Laboratory and all governmental agencies having jurisdiction and until copies are at the job site.

1.07 MOCK-UP

- A. Field Sample (Panels for texture and color approvals only)
 - 1. In an area on the site where approved by the Architect, provide sample masonry panels.
 - a. Make each sample panel approximately 4'-0" high and 6'-0" long.
 - b. Provide one sample panel for each combination of masonry units, bond pattern, mortar color, and joint type used in the Work.
 - c. For renovation projects, locate panel adjacent to existing building to allow side by side viewing of both existing building and panel. Panel shall be located in an area that receives both direct sun and shade.
 - d. Revise as necessary to secure approval from Owner and Architect.
 - e. Completely demolish and remove from the job site upon completion and acceptance of the work.
- B. Mock-Ups (Wall for quality control purposes)
 - 1. A mock-up wall shall be constructed only after the pre-installation conference.
 - 2. The Architect shall select a section of exterior wall within the building that shall be used for a wall mock-up to determine quality of workmanship for the entire project. The mock-up shall consist of approximately 50 lineal feet of exterior wall and shall include straight wall, corners, control and expansion joints, window installation, anchors and reinforcing, and flashings. This mock-up shall incorporate all aspects of the accepted masonry sample panel as well including proper cleaning techniques. Cleaning agent manufacturer's representative shall be on site to observe and instruct the cleaning portion.
 - 3. Installation of all materials and products into the wall shall be in accordance with all applicable specifications as noted in the project manual and as shown on the drawings.
 - 4. Upon completion and acceptance of the wall mock-up and quality of workmanship, the wall shall be photographically documented by the Contractor as a record. Provide one copy of photos to each the Owner, the Architect and the Contractor. The wall shall then be incorporated into the project and shall be the standard for all masonry work on the project.

5. No work shall proceed until the mock-up wall is approved.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.
- B. All masonry products stored on site shall be properly covered from the weather to prevent deterioration and moisture penetration. Broken or damaged masonry products shall be rejected. Do not double-stack pallets.
- C. Storage and protection of masonry embedded flashing;
 1. Comply with manufacturer's recommendations for storage and handling of each product.
 2. Wall Flashing and Surface Conditioner shall be delivered in the original, unopened manufacturer's containers with all labeling information fully visible.
 3. On-Site Storage of unopened cartons shall be such that the material is kept dry and is not stored at temperatures in excess of 100 deg. F. Pallets of cartons should not be double stacked for on-site storage.
 4. Surface Conditioner is non-flammable. Refer to product label before use.
- D. Acceptance at Site
 1. Deliver materials in manufacturer's unopened containers, fully identified with name, brand, type, and grade.
 2. Materials with missing or illegible identification shall be rejected.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. Manufacturers:
 1. Boral Concrete Products: www.boralconcreteproducts.com
 2. Oldcastle Architectural, Jewell Concrete Products: www.jewellcp.com.
 3. Spectra Development Corporation: www.spectraglaze.com.
 4. Texas Building Products, Inc.: www.texasbuildingproducts.com.
 5. Trenwyth Industries, Inc.: www.echelonmasonry.com.
 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. Standard Concrete Masonry Units: Comply with referenced standards and as follows:
 1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.
 2. Special Shapes: Provide non-standard blocks configured for corners, lintels, headers, control joint edges, and other detailed conditions.
 3. Use bullnose type concrete masonry units at all edges and exterior corners, except where ceramic wall tile is scheduled.
 4. Load Bearing/Non-Load Bearing Units: ASTM C90, lightweight.
 5. Load-Bearing Units/ Non-Loadbearing Units: ASTM C90, normal weight
 - a. Provide at all sound wall locations unless noted otherwise.
 6. 4" wide units shall be provided as hollow cell units.

2.02 BRICK UNITS

- A. Manufacturers:
 1. Acme Brick Company: www.brick.com
 2. Elgin Butler Company: www.elginbutler.com.
 3. Endicott Clay Products Co: www.endicott.com.
 4. General Shale Brick: www.generalshale.com.
 5. Meridian Brick LLC : www.meridianbrick.com/#sle.
 6. Interstate Brick: www.interstatebrick.com
 7. Sioux City Brick: www.siouxcitybrick.com

8. Summit Brick: www.summitbrick.com
 9. Kansas Brick and Tile/Cloud Ceramics: www.kansasbrick.com
 10. Substitutions: See section 01 6000 - Product Requirements.
- B. Facing Brick: ASTM C216, Type FBS Smooth, Grade SW.
1. Color and texture: Refer to Schedule of Materials and Colors.
 2. Nominal size: King Size.
 3. Special shapes: Provide special shapes at all intersections not equal to 90 degrees to conform to the brick selected or of the same type and finish in the brick allowance. Where solid brick are noted on the plans, provide brick of appropriate size without cores.
 4. Compressive strength: As measured in accordance with ASTM C67.

2.03 MORTAR AND GROUT MATERIALS

- A. Mortar and Grout: As specified in Section 04 0511.

2.04 REINFORCEMENT AND ANCHORAGE

- A. Manufacturers:
1. Blok-Lok Limited: www.blok-lok.com/#sle.
 2. Hohmann & Barnard, Inc: www.h-b.com/sle.
 3. PROSOCO, Inc: www.prosoco.com.
 4. WIRE-BOND www.wirebond.com/#sle.
 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. In addition to all other specification requirements, veneer anchors shall be designed by a professional engineer licensed in Texas, hired by the Contractor, where the horizontal distance is greater than 4 1/2 inches between the inside face of the masonry veneer (e.g. brick, concrete masonry, cast stone, etc...) and the outside face of the structural backup system (e.g. CMU, ICF, face of cold formed metal framing members, etc...).
- C. Reinforcing Steel: Type specified in Section 03 2000; size as indicated on drawings; uncoated finish.
- D. Wire reinforcement: Reinforced hot dip galvanized wall reinforcing in conformance with ASTM A951, for high tensile steel. hot-dipped galvanized to comply with ASTM A153, Class B mill-galvanized wire reinforcement shall not be permitted on any part of the project. 9 gage wire, deformed to develop minimum surface bond of 527 PSI when cast in ASTM Class A mortar cubes. Provide rod spacings and veneer anchor dimensions to locate rods and veneer anchors in mortar to comply with the requirements of the applicable version of the Masonry Standards Joint Committee document TMS 402, referring to the construction drawings for dimensions of wythe thicknesses and dimensions between wythes.
- E. Veneer anchor wires: Reinforced hot dip galvanized wire in conformance with ASTM A951, for high tensile steel, hot-dipped galvanized to comply with ASTM A153, Class B. Mill-galvanized wire reinforcement shall not be permitted on any part of the project. 9 gage wire. Provide rod spacings and veneer anchor dimensions to locate rods and veneer anchors in mortar to comply with the requirements of the applicable version of the Masonry Standards Joint Committee document TMS 402, referring to the construction drawings for dimensions of wythe thicknesses and dimensions between wythes.
- F. Horizontal Bedjoint Reinforcement in Concrete Masonry, and Masonry Veneer Anchors with Concrete Masonry Backup Systems: Install bedjoint reinforcement at 16" on center in all concrete masonry walls, excluding masonry veneer wythes unless they are laid at the same time as backup masonry. Horizontal bedjoint reinforcement, as well as deformed rebar, shall continue through all crack control joints in all concrete masonry walls (both load-bearing and non-load-bearing, both interior and exterior).
1. Single-wythe concrete masonry walls without masonry veneer: Ladder Type, using #220 Ladder-Mesh as manufactured by Hohmann & Barnard, Inc or equal.

2. Single-wythe concrete masonry backup with masonry veneer laid at the same time: Ladder Type, using #230 Ladder-Tri-Mesh as manufactured by Hohmann & Barnard, Inc or equal.
 3. Single-wythe concrete masonry backup with masonry veneer laid after backup wythe: Install one of the following two options:
 - a. Provide bedjoint reinforcement with eyelets flush-welded, so as to avoid wire buildup of wire laminations, and adjustable double-pintle-leg anchors at 16" on center along the bedjoint reinforcement, using Adjustable Truss Lox-All Adjustable Eye-Wire with TRU-JOINT as manufactured by Hohmann & Barnard, Inc or equal, or
 - b. Provide bedjoint reinforcement without eyes, as noted above for Single-wythe concrete masonry walls without masonry veneer, and in alternating bedjoints with bedjoint reinforcement so as to avoid wire buildup of wire laminations, provide Adjustable Wall Ties (Pintles and Eyes) as manufactured by Hohmann & Barnard, Inc or equal, at 16" on center each way.
 4. Multiple-wythe concrete masonry walls, excluding masonry veneer wythes: Composite Truss Type with two rods in each wythe, using #140 Truss Twin-Mesh as manufactured by Hohmann & Barnard, Inc or equal. At walls with more than two structural wythes, alternate pairs of wythes being tied together at 8" on center so that each pair of wythes is being tied together at 16" on center.
 - a. To anchor masonry veneer to multiple-wythe concrete masonry backup systems: Install Adjustable Wall Ties (Pintles & Eyes) as manufactured by Hohmann & Barnard, Inc or equal at 16" on center each way.
- G. Masonry Veneer Anchors with Cast-in-place Concrete Backup Systems:
1. At concrete backup systems formed with Expanded Polystyrene Formwork (Insulating Concrete Forms): It shall NOT be permitted to permanently anchor masonry veneer by anchoring to flanges of ICF web materials embedded in the expanded polystyrene, such as plastic or light-gage metal. One of the following options shall be installed:
 - a. 2-SEAL Concrete Ties with 2-SEAL Byna-Lok Wire Ties as manufactured by Hohmann & Barnard, Inc or equal embedded in the concrete with a maximum vertical spacing of 18" and a maximum horizontal spacing of 16".
 - b. Adjustable sheet metal anchors customized for the ICF industry and embedded in the concrete, using TIE-KEY adjustable sheet metal anchors as manufactured by Reward Wall Systems, or equal, to be mounted temporarily on plastic flanges of ICF web material, at a maximum tributary area of 1.5 square feet (e.g. 16" vertical and 12" horizontal for Reward Systems; 18" vertical and 8" horizontal for Nudura wall systems). Anchors shall be hot-dipped galvanized to comply with ASTM A153, Class B.
 2. At concrete backup systems with temporary forms that are removed, one of the following options shall be installed:
 - a. Before concrete is poured, mount 22 ga hot-dip galvanized dovetail channels to receive dovetail veneer anchors, using #305 Dovetail Slot as manufactured by Hohmann & Barnard, Inc or equal. After concrete is poured and temporary forms are removed, install 12 ga hot-dip galvanized dovetail anchors with vee wall ties at 16" on center each way, using #315 Flexible Dovetail Brick Tie as manufactured by Hohmann & Barnard, Inc., or equal.
 - b. If dovetail channels are not installed as noted above, the Contractor shall be permitted to install a two-piece concrete anchored adjustable wire tie system at 16" on center each way, using 2-SEAL Concrete Ties with 2-SEAL Byna-Lok Wire Ties as manufactured by Hohmann & Barnard, Inc. or equal with concrete screws as recommended by the manufacturer.
 - c. For precast concrete systems at storm shelters:
 - 1) Anchors shall have 1 1/2" maximum penetration into concrete

- 2) Wall reinforcement shall be located with nondestructive methods (e.g. ferroscanning equipment)
 - 3) Drilling for anchors shall be done with masonry drill bit incapable of penetrating steel reinforcing.
 - 4) For spalls or any other damage to the precast concrete, walls shall be repaired as required by Precast Concrete Engineer.
- H. Masonry Veneer Anchors with Stud Backup Systems: Install a two piece anchored adjustable wire tie system at 16" on center each way, with screws as recommended by the manufacturer and as required by the applicable version of TMS 402.
1. Exterior stud walls with masonry veneer:
 - a. Thermal 2-Seal Wall Ties as manufactured by Hohmann & Barnard, Inc.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
 2. Interior stud walls with masonry veneer:
 - a. DW-10 Wall Ties as manufactured by Hohmann & Barnard, Inc.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.05 FLASHINGS

- A. Through Wall Flashing Materials: Products as specified in Sections 07 2500 and 07 6200.

2.06 ACCESSORIES

- A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
1. Manufacturers:
 - a. Blok-Lok Limited: www.blok-lok.com.
 - b. Hohmann & Barnard, Inc: www.h-b.com/sle.
 - c. WIRE-BOND: www.wirebond.com/#sle.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- B. Joint Filler: Closed cell polyethylene; oversized 50 percent to joint width; self expanding; 1/2 inch wide by maximum lengths available.
1. Manufacturers:
 - a. Hohmann & Barnard, Inc: www.h-b.com/sle.
 - b. WIRE-BOND: www.wirebond.com/#sle.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
1. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
 - a. Manufacturers:
 - 1) Hohmann & Barnard, Inc; Mortar Trap: www.h-b.com/sle.
 - 2) Mortar Net Solutions; MortarNet: www.mortarnet.com/#sle.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.
- D. Nailing Strips: Softwood lumber, preservative treated; as specified in Section 06 1000.
- E. Weeps:
1. Type: Molded PVC grilles, insect resistant.
- F. Cavity Vents:
1. Type: Molded PVC grilles, insect resistant.
- G. Bond Break Material - Provide one layer of 6 mil polyethylene equal to "Visqueen Vapour Barrier" as a bond breaker between all clay masonry and CMU in the same wythe. Rake joint back 3/8" and provide continuous sealant at joint.

2.07 LINTELS

- A. All concrete masonry lintels, not including 4" nominal concrete masonry veneer lintels, shall be reinforced concrete masonry lintels as specified on the Structural Drawing Sheets unless steel beam supports are shown on the Structural Drawings. Where steel beam supports are shown, the concrete masonry shall be bonded to the top of the steel beam with 1/2" diameter Nelson D2Lbars x 24" long at 16" on center.
- B. All exterior masonry veneer supports over openings shall be as shown on the Structural Drawings.
- C. For interior masonry veneers with an air space between the veneer and backup, Interior masonry veneer supports over openings shall be the same as for exterior veneer supports, as shown on the Structural Drawings.
- D. For interior masonry veneer with a mortar-filled collar joint shown on the Drawings, interior masonry veneer supports shall be loose steel lintels as scheduled on the Structural Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Contractor shall note that the dimensions shown on the floor plans and plan details are nominal masonry dimensions. The contractor is responsible for coordinating the masonry layout to provide 3/8" joints. If conflict occurs, contractor shall contact Architect prior to installing masonry.
- B. Verify that field conditions are acceptable and are ready to receive masonry.
- C. Verify that related items provided under other sections are properly sized and located.
- D. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.
- C. Surface Preparation for Masonry Units
 1. Do not commence installation until foundations are clean, rough, and level.
 2. Remove all laitance and foreign material from top of foundation.
 3. Verify that the foundation elevation is such that the bed joint thickness will be between 3/8" and 1/2", and that the foundation edge is true to line.
 4. Clean projecting dowels free from loose scale, dirt, concrete, and other material that will inhibit bond.
 5. Verify that dowels are in proper location.
- D. Surface Preparation for Rubberized Asphalt Flashing
 1. Apply primer by brush or heavy nap, natural-material roller at rate recommended by manufacturer prior to flashing installation. Allow primer to dry completely before flashing application.
- E. Collection System and Weeps
 1. Clean flashing and weep holes so they are free of mortar droppings and debris immediately prior to installing collection system or weep.
 2. Remove projecting mortar and other protrusions from substrate.
 3. Remove mortar and debris from cavity spaces, wall ties, and reinforcing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

- A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

- B. During cold weather construction do not lay masonry units unless the temperature is 40 degrees Fahrenheit and rising.
- C. During hot weather construction (ambient air temperature exceeds 100 degrees Fahrenheit or 90 degrees Fahrenheit with wind velocity greater than 8 mph) do not spread mortar beds more than 4 feet ahead of masonry and set brick masonry within 1 minute of spreading mortar. Fog spray cure twice daily at four hour intervals for three days during hot weather.
- D. Protect masonry construction from direct exposure to wind and sun when erected in ambient air temperature of greater than 99 degrees Fahrenheit in the shade, with relative humidity less than 50 percent.
- E. During hot weather protect brick masonry units from sun until units are ready to be placed in the wall.

3.04 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Bed joints in masonry units shall course out with bed joints in adjacent masonry wythes at vertical intervals of 16".
- D. Cut out and repoint defective joints.
- E. On all joints exposed to the weather, tool and make smooth, solid, and watertight.
- F. All joints shall be thumbprint hard prior to tooling.
- G. Use 18" sled on bed joints, brush wall, and retool joints.
- H. Concrete Masonry Units:
 - 1. Bond: Running.
 - 2. Coursing: One unit and one mortar joint to equal 8 inches.
 - 3. Mortar Joints: Concave at conditions exposed to view. Strike joints flush where a fluid applied weather barrier will be installed as specified in Section 07 2500 - Weather Barriers.
 - 4. Align vertical cells of hollow units to maintain a clear and unobstructed system of flues.
- I. Brick Units:
 - 1. Bond: Running.
 - 2. Coursing: Three units and three mortar joints to equal 8 inches.
 - 3. Mortar Joints: Concave.

3.05 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- D. Remove excess mortar and mortar smears as work progresses.
- E. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.
- F. Interlock intersections and external corners, except for units laid in stack bond.
- G. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- H. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

- I. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.
- J. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.
- K. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.
- L. Brick and CMU wythes shall be laid in a true and straight alignment. Exterior masonry shall be laid-up separately.
- M. Unless otherwise indicated on the Drawings, install masonry plumb, level, and true to line, with square angles and corners. Do not commence installation of the work until horizontal and vertical alignment of the foundation is within 1" plumb and the lines shown on the Drawings.
- N. Use line blocks whenever possible. When it is absolutely necessary to use a line pin, fill the hole immediately after the pin is withdrawn.
- O. Use only masonry that are clean and free from dust and other foreign matter and lay only dry masonry units.
- P. Do not use bonding headers on grouted masonry unless specifically so directed by the Architect.
- Q. Masonry with cracks and or chipped faces will be rejected if non-compliant with the limits noted in ASTM C216. If such units are discovered in the finished wall, the Contractor shall remove the units and replace with new units at no cost to the Owner.
- R. Lay only dry concrete masonry units.
- S. Accurately fit the units to plumbing, ducts, openings, and other interfaces, neatly patching all holes.
- T. Keep the walls continually clean, preventing grout and mortar stains. If grout does run over, clean immediately.
- U. Bed joints: A complete mortar-to-unit bond is required on all masonry.
 - 1. Avoid fins of bed joints protruding into grout space or cavity.
 - a. If they occur, leave in place if not projecting more than the bed joint thickness.
 - b. Do not, in any case, cut off and drop into the grout space or cavity.
- V. Head joints: Regardless of thickness, completely fill with mortar or grout. Do not slush full.
- W. Lay both Wythes of the wall to a line.
- X. Provide reinforcement as shown on the drawings, fully embedded in grout and not in mortar or mortar joints. Provide required metal accessories to insure adequate alignment of steel during grout filling operations.
- Y. At locations where items are mounted on/against split face CMU (i.e. door/window jambs, fire extinguisher cabinets, electric water coolers, etc.), grind split face CMU to allow flush, level installation.

3.06 WEEPS/CAVITY VENTS

- A. Place weep vents in head joints at exterior wythe of cavity wall located immediately above all flashings, ledges, heads of lintels, sills, and low roof to high wall conditions spaced 24 inches on center for clay and stone masonry units and 32 inches on center for concrete masonry units, unless otherwise shown. Leave the side of the masonry units clear from mortar (unbuttered) forming the vent space.
 - 1. Place the vent material into joint, directly on top of flashing material, prior to installing the second masonry unit.
 - 2. Install the weep vents as the wall is being erected so joints do not become filled with mortar or debris.
 - 3. Install a minimum of two weeps above each exterior door/window.

- B. Install cavity vents in veneer and cavity walls at 24 or 32 inches on center horizontally near top of walls.

3.07 CAVITY MORTAR CONTROL

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.
- B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.
- C. Install 1 continuous row at base of wall and over all wall openings directly on flashing. To prevent mortar bridging between the outer wythe and inner wall, install flashing extending from the bottom of the collection system to at least 6" above the top of the collection system.
- D. Install with the offset edge pointing up the wall.
- E. Lay the first 1 or 2 courses of masonry at flashing level, then install the collection system continuously by placing it against the inside of the openings. No fasteners or adhesives are required.
- F. Compress the collection system horizontally so it can be forced into cavities slightly smaller than its nominal thickness without affecting performance. When forcing the collection system into a cavity, be sure mortar has set sufficiently to resist outward pressure from product.

3.08 REINFORCEMENT AND ANCHORAGE - GENERAL, SINGLE WYTHER MASONRY, AND CAVITY WALL MASONRY

- A. Refer to the Structural and Architectural Drawings for reinforcement required in masonry.
- B. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.
- C. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- D. Place continuous joint reinforcement in first and second joint below top of walls.
- E. Lap joint reinforcement ends minimum 6 inches.
- F. Do not install masonry anchors at locations where fasteners will penetrate through wall flashing.
- G. Do not use reinforcement having any of the following defects.
 - 1. Bar lengths, depths, or bends exceeding the specified tolerances.
 - 2. Bends or kinks not indicated on the Drawings or required for the Work.
 - 3. Bars with cross-section reduced due to excessive rust or other causes.
- H. Masonry Tie Installation: Set wall plate in full bed of compatible sealant over substrate. Install fasteners to engage structural framing/masonry, ensuring fasteners are installed snug and straight. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 16 inches horizontally and 16 inches vertically.

3.09 MASONRY FLASHINGS

- A. Coordinate masonry work with installation of metal and membrane through wall flashings in accordance with Sections 07 2500 and 07 6200.
- B. Laying Masonry Walls at Flashings:
 - 1. Provide a solid surface at flashing areas using inverted lintels, solid or filled masonry units. Flash at all breaks in wall face where cells are not grouted.
 - 2. At wall base flashings, place mortar bed on top of flashing.

3.10 GROUTED COMPONENTS

- A. Fill one cell of CMU with grout and 1 - #5 bar vertical at each window and door jamb in CMU walls, from floor level to top of wall.

- B. Fill 3 cells of CMU with grout and 1 - #5 bar vertical in each cell at all exterior corners of CMU walls, fill full height of wall and extend #5 bar into bond beam a minimum of 6" then bend 90° and extend a minimum of 6".
- C. See drawings for other areas of grout fill required in CMU.
- D. Where the collar joint is to be grouted between the wythes of masonry, provide expanded metal or mortar/grout screen at the beginning of the grout.
- E. All vertical bars shall be dowelled to the foundations with same size reinforcing bar.
- F. Lap splices minimum 48 bar diameters.
- G. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- H. Place and consolidate grout fill without displacing reinforcing.
- I. At bearing locations, fill masonry cores with grout for a minimum 8 inches either side of opening.

3.11 CONTROL AND EXPANSION JOINTS

- A. Locate 3/8" wide expansion and control joints as indicated on the drawings. However in no case shall they exceed 20'-0" in distance. Contractor shall ensure that joints occur at intervals no more than as noted above and notify the Architect for coordination of placement if additional joints are required. Keep vertical joints straight, true and continuous from top to bottom of masonry.
 - 1. Expansion joints shall be completely free of mortar and the joint reinforcement shall not continue across the expansion joint. Keep vertical joints straight, true and continuous from top to bottom of masonry. Detail joint as shown on the drawings
 - 2. At control joints horizontal reinforcing shall run continuous through joint. Detail joint as shown on the drawings.
- B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
- C. Form expansion joint as detailed on drawings.

3.12 BUILT-IN WORK

- A. As work progresses, install built-in metal door frames and glazed frames and other items to be built into the work and furnished under other sections.
- B. Install built-in items plumb, level, and true to line.
- C. Bed anchors of metal door frames in adjacent mortar joints. Fill frame voids solid with grout.
 - 1. Fill adjacent masonry cores with grout minimum 8 inches from framed openings.
- D. Do not build into masonry construction organic materials that are subject to deterioration.

3.13 TOLERANCES

- A. Maximum Variation from Alignment of Columns: 1/4 inch.
- B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
- D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
- F. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.
- G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.14 CUTTING AND FITTING

- A. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other sections of work to provide correct size, shape, and location.
- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.15 FIELD QUALITY CONTROL

- A. A Special Inspection and Testing Agency (SITA) will perform field quality control tests and inspections, as specified in Sections 01 4516 and 01 4533.

3.16 CLEANING

- A. Remove excess mortar and mortar droppings.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.

3.17 PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.
- B. The masonry walls shall be covered at the end of each workday and when work is not in progress. The walls shall be covered with heavy plastic sheeting or water repellent tarps and shall extend a minimum of 2'-0" down each side of the wall and be securely held in place.

END OF SECTION

**SECTION 05 1200
STRUCTURAL STEEL FRAMING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. Structural steel.
- B. Related Sections:
1. Section 01 4523 "Testing and Inspection Services".
 2. Section 05 3113 "Steel Floor Decking".
 3. Section 05 3123 "Steel Roof Decking".
 4. Section 05 5000 "Metal Fabrications".

1.3 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.
- C. Heavy Sections: Rolled and built-up sections as follows:
1. Shapes included in ASTM A 6 with flanges thicker than 1 1/2 inches.
 2. Welded built-up members with plates thicker than 2 inches.
 3. Column base plates thicker than 2 inches.
- D. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.
- E. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

1.4 REFERENCES

- A. Comply with applicable provisions of the following specifications and documents: The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise
1. AISC "Code of Standard Practice for Steel Buildings and Bridges".
 2. AISC "Specification for Structural Steel Buildings," including the "Commentary" and the Supplements thereto, as issued.
 3. AISC "Specification for Architecturally Exposed Structural Steel".
 4. AISC's "Seismic Provisions for Structural Steel Buildings".
 5. ASTM A 6 "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use".
 6. AWS D1.1 Structural Welding Code.
 7. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".
 8. Research Council on Structural Connections' (RCSC) "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".
 9. SSPC (Steel Structures Painting Council), Painting Manuals, Volumes 1 and 2.
 10. UL Fire Resistance Directory.
- B. In the case of conflict between the Contract Documents and a reference standard, the Contract Documents shall govern. In the case of a conflict between the Contract Documents and the Building Code, the more stringent shall govern.

1.5 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Prepare submittal documents including connection design calculations and drawings signed and sealed by registered design professional, licensed in state where project is located, employed by the steel fabricator.
- B. Design all structural steel framing connections complying with specified performance:
1. Load Capacity: Resist loads indicated on drawings or resist full capacity of supported framing member if reaction not indicated. Account for connection and member loads and eccentricities.
 - a. Request additional design criteria when necessary to complete connection design.
 2. Configuration: Design and detail all connections for each member size, steel grade and connection type to resist the loads and reactions indicated on the drawings or specified herein. Use details consistent with details shown on drawings, supplementing where necessary. The details shown on drawings are conceptual and do not indicate the required weld sizes or number of bolts unless specifically noted. Use rational engineering design and standard practice in detailing, accounting for all loads and eccentricities in both the connection and the members. Promptly notify the design professional in charge of any location where the connection design criteria is not clearly indicated. The design of all connections is subject to the review and acceptance of the design professional in charge. Submit structural calculations prepared and sealed by a qualified engineer registered in the state where the project is located. Submit calculations for review before preparation of detail drawings.
- C. Construction: System as indicated on Drawings.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
 - 5. Identify members and connections of the seismic-load-resisting system.
 - 6. Indicate locations and dimensions of protected zones.
 - 7. Identify demand critical welds.
 - 8. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. At full penetration welds, Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:
 - 1. Power source (constant current or constant voltage).
 - 2. Electrode manufacturer and trade name, for demand critical welds.

1.7 INFORMATIONAL SUBMITTALS

- A. Submit the following informational submittals:
 - 1. Qualification Data: For qualified installer, fabricator, and testing agency.
 - 2. Welding certificates.
 - 3. Mill test reports for structural steel, including chemical and physical properties.
 - 4. Product Test Reports: For the following:
 - a. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - b. Direct-tension indicators.
 - c. Tension-control, high-strength bolt-nut-washer assemblies.
 - d. Shear stud connectors.
 - e. Shop primers.
 - 5. Source quality-control reports.

1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator with a minimum of (5) years of experience that participates in the AISC Quality Certification Program for Category I or higher structures and is designated and is designated an AISC-Certified Plant, Category STD. An otherwise qualified fabricator who is not a member of the AISC Quality Certification Program will be accepted if satisfactory evidence of qualifications is submitted prior to award of Contract. For non-certified fabricators, Contractor shall submit a resume describing plant size, equipment quality control procedures and personnel, and experience on comparable work in the last five (5) years.

- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
- C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1, P2, or P3 as applicable for exposure or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
- E. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303.
 - 2. AISC 341 and AISC 341s1.
 - 3. AISC 360.
 - 4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- F. Preinstallation Conference: Conduct conference at Project site.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 - 2. Clean and re-lubricate bolts and nuts that become dry or rusty before use.
 - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.10 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than the following:
 - 1. W-Shapes: 60 percent.
 - 2. Channels, Angles, M, S-Shapes: 60 percent.
 - 3. Plate and Bar: 25 percent.
 - 4. Cold-Formed Hollow Structural Sections: 25 percent.
 - 5. Steel Pipe: 25 percent.
 - 6. All Other Steel Materials: 25 percent.
- B. W-Shapes: Refer Structural General Notes.
- C. Channels, Angles, M, S-Shapes: Refer Structural General Notes.
- D. Plate and Bar: Refer Structural General Notes.
- E. Corrosion-Resisting Structural-Steel Shapes, Plates, and Bars: ASTM A 588, Grade 50.
- F. Cold-Formed Hollow Structural Sections: Refer Structural General Notes.
- G. Steel Pipe: Refer Structural General Notes.
 - 1. Weight Class: See Plans.
 - 2. Finish: Black except where indicated to be galvanized.
- H. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.
- B. Zinc-Coated High-Strength Bolts, Nuts, and Washers (All bolts located in Crawl Space): ASTM A 325, Type 1, heavy-hex steel structural bolts.
 - 1. Finish: Hot-dip or mechanically deposited zinc coating.
 - 2. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with mechanically deposited zinc coating finish.
- C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex or round head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
 - 1. Finish: Plain or Mechanically deposited zinc coating, where required.
- D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

- E. Unheaded Anchor Rods: ASTM F 1554, See Anchor Bolt Schedule on Drawings for Grade.
 - 1. Configuration: Straight.
 - 2. Nuts: ASTM A 563 heavy-hex carbon steel.
 - 3. Plate Washers: ASTM A 36 carbon steel.
 - 4. Washers: ASTM F 436, Type 1, hardened carbon steel.
 - 5. Finish:
 - a. General Condition – Plain
 - b. Crawl Space - Hot-dip zinc coating, ASTM A 153, Class C.
- F. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.
- G. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.
- H. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.
- I. Structural Slide Bearings: Low-friction assemblies, of configuration indicated, that provide vertical transfer of loads and allow horizontal movement perpendicular to plane of expansion joint while resisting movement within plane of expansion joint.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Amscot Structural Products Corp.
 - b. Fluorocarbon Company Limited.
 - c. R.J. Watson Bridge & Structural Engineered Systems.
 - d. Seismic Energy Products, L.P.
 - 2. Mating Surfaces: PTFE and PTFE or mirror-finished stainless steel.
 - 3. Coefficient of Friction: Not more than 0.05.
 - 4. Design Load: Not less than 5,000 psi .
 - 5. Total Movement Capability: 2 inches.

2.3 PRIMER

- A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Primer (General): Fabricator's standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- C. Primer (Crawl Space Steel): Tnemec Perimeprime Series 394.
- D. Galvanizing Repair Paint: SSPC-Paint 20.

2.4 GROUT

- A. Refer Section 03 3000.

2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
1. Camber structural-steel members where indicated.
 2. Fabricate beams with rolling camber up.
 3. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
 4. Mark and match-mark materials for field assembly.
 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in final approved Shop Drawings.
1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize field handling of materials.
 2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other effects.
 3. Camber structural steel members where indicated. The camber specified is the camber that is measured in the field with the beam on its side so that the beam weight has no effect. During shipment and handling, cambered members shall be supported in a way that will not result in loss of camber.
 4. Camber tolerance
 - a. Beams 50 feet and less; plus or minus 1/2 inch.
 - b. Beams greater than 50 feet; plus or minus 1/2 inch, except tolerance can be increased 1/8 inch for each 10 feet or fraction thereof in excess of 50 feet.
 - c. Contact engineer for members outside specified camber tolerance. Provide engineer with a list of beam locations and actual measured camber amounts. Submit an engineered shoring plan, if requested, that will allow the beam to deflect to the horizontal position after concrete placement without overloading the framing below.
 5. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.
 6. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.
- C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- D. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- F. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 3, "Power Tool Cleaning."
- G. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

- H. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on approved shop drawings.
 - 1. Provide threaded nuts welded to framing, and other specialty items as indicated to receive other work.
 - 2. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes by burning.
- I. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces. Base plates hole sizes for anchor bolts may be oversized to facilitate erection:
 - 1. Bolts 3/4 inch to 7/8 inch diameter: 1/2 inch oversize.
 - 2. Bolts 1 inch to 1 1/2 inch diameter: 3/4 inch oversize.
 - 3. Bolts over 1 3/4 inch diameter: 1 inch oversize.
- J. Base Plate Washers: Sizes shall be as follows:
 - 1. 3/4 inch diameter Bolts: 2 inch diameter x 1/4 inch thick
 - 2. 7/8 inch diameter Bolts: 2 1/2 inch diameter x 5/16 inch thick
 - 3. 1 inch diameter Bolts: 3 inch diameter x 3/8 inch thick
 - 4. 1 1/4 inch diameter Bolts: 3 inch diameter x 1/2 inch thick
 - 5. 1 1/2 inch diameter Bolts: 3 1/2 inch diameter x 1/2 inch thick
 - 6. 1 3/4 inch diameter Bolts: 4 inch diameter x 5/8 inch thick
 - 7. 2 inch diameter Bolts: 5 inch diameter x 3/4 inch thick

2.6 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened, Pretensioned, or Slip critical as required or indicated on Drawings.
- B. Weld Connections: Comply with AWS D1.1 and AWS D1.8, where required, for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 - 2. Surfaces to be field welded.
 - 3. Surfaces to be high-strength bolted with slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing) excluding crawl space steel. Crawl space steel shall be primed regardless of whether it is to receive fireproofing.
 - 5. Galvanized surfaces.

- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
- D. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.
- E. Crawl space steel to be primed to a DFT between 2.5 and 3.5 mils.
- F. Painting: Prepare steel and apply a one-coat, non-asphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123.
 - 1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
 - 2. Galvanize lintels and shelf angles attached to structural steel frame and located in exterior walls.
 - 3. Exposed exterior structural steel.

2.9 SOURCE QUALITY CONTROL

- A. Testing Agency: Refer Section 01 45 23.
 - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with steel Erector present, elevations of concrete and masonry bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - 1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
 - 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations, to elevations indicated, and according to AISC 303 and AISC 360.
- B. Base Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow it to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection unless approved by Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened, Pretensioned, or Slip critical as indicated on Drawings.

- B. Weld Connections: Comply with AWS D1.1 and AWS D1.8 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
 - 3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: See Section 01 4523.

- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION

**SECTION 05 2100
STEEL OPEN WEB JOIST FRAMING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. K-series steel joists.
 2. KCS-type K-series steel joists.
 3. K-series steel joist substitutes.
 4. LH- and DLH-series long-span steel joists.
 5. CJ-series composite steel joists.
 6. Joist girders.
 7. Joist accessories.
 - a. Extended ends.
 - b. Ceiling extensions.
 - c. Bearing plates.
 - d. Bridging.
 - e. Side wall anchors.
- B. Related Requirements:
1. Section 03 3000 "Cast-in-Place Concrete".
 2. Section 01 4523 "Testing and Inspection Services"
 3. Section 04 2000 "Unit Masonry".
 4. Section 05 1200 "Structural Steel Framing".
 5. Section 05 3123 "Steel Roof Decking".

1.3 REFERENCES

- A. Comply with applicable provisions of the following specifications and documents. The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise.
1. AWS D1.1 Structural Welding Code
 2. SJI "Standard Specification Load Tables and Weight Tables for Steel Joists and Joist Girders".
 3. SDI "Design Manual for Composite Decks, Form Decks, Roof Decks, Cellular Metal Floor Deck with Electrical Distribution".
 4. SSPC Steel Structures Painting Council Painting Manual.
 5. UL Fire Resistance Directory.
 6. ICBO Product Evaluation Reports.
 7. FM Roof Assembly Classifications.

- B. In the case of conflict between the Contract Documents and a reference standard, the Contract Documents shall govern. In the case of a conflict between the Contract Documents and the Building Code, the more stringent shall govern.

1.4 DEFINITIONS

- A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."
- B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support non-uniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of joist, accessory, and product.
- B. Shop Drawings:
 - 1. Include layout, designation, number, type, location, and spacing of joists.
 - 2. Include joining and anchorage details, bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
 - 3. Indicate locations and details of bearing plates to be embedded in other construction.
 - 4. Shop drawings containing special joists shall be submitted with a design load summary for each special joist design. Load summary will be reviewed and returned with the joist submittal. Shop drawings containing special joists submitted without the specified load summary will be returned unchecked as an incomplete submittal. Shop drawings containing special joists shall be signed and sealed by the qualified professional engineer responsible for the design of the joists.

1.6 INFORMATIONAL SUBMITTALS

- A. Submit the following informational submittals:
 - 1. Qualification Data: For manufacturer.
 - 2. Welding certificates.
 - 3. Manufacturer certificates.
 - 4. Mill Certificates: For each type of bolt.
 - 5. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications."
 - 1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.
- B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle joists as recommended in SJI's "Specifications."
- B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.9 SEQUENCING

- A. Deliver steel bearing plates to be built into cast-in-place concrete and or masonry construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.
 - 1. Use ASD; data are given at service-load level.
 - 2. Design special joists to withstand design loads with live-load deflections no greater than the following:
 - a. Floor Joists: Vertical deflection of 1/360 of the span.
 - b. Roof Joists: Vertical deflection of 1/360 of the span.
- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.

2.2 MATERIALS

- A. Steel: Comply with SJI's "Specifications" for chord and web members.

2.3 K-SERIES STEEL JOISTS

- A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
 - 1. Joist Type: K-series steel joists and KCS-type K-series steel joists.
- B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.
- C. Provide holes in chord members for connecting and securing other construction to joists.
- D. Top-Chord Extensions and Extended Ends: Provide top chord extension or extended ends where shown on plans. Design for load indicated on plans.

- E. Camber joists according to SJI's Specifications unless noted otherwise.
- F. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.4 LONG-SPAN STEEL JOISTS

- A. Manufacture steel joists according to "Standard Specifications for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements as indicated on plan.
 - 1. Joist Type: Refer to Drawings.
 - 2. End Arrangement: Refer to Drawings.
 - 3. Top-Chord Arrangement: Refer to Drawings.
- B. Provide holes in chord members for connecting and securing other construction to joists.
- C. Camber long-span steel joists according to SJI's Specifications unless noted otherwise.
- D. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.5 JOIST GIRDERS

- A. Manufacture joist girders according to "Standard Specifications for Joist Girders" in SJI's "Specifications," with steel-angle top- and bottom-chord members; with end and top-chord arrangements as indicated on plan.
 - 1. End Arrangement: Refer to Drawings.
 - 2. Top-Chord Arrangement: Refer to Drawings.
- B. Provide holes in chord members for connecting and securing other construction to joist girders.
- C. Camber joist girders according to SJI's Specifications unless noted otherwise.
- D. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.6 PRIMERS

- A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.7 JOIST ACCESSORIES

- A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" and "Standard Specifications for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.
- B. Fabricate steel bearing plates from ASTM A 36/A 36M steel with integral anchorages of sizes and thicknesses indicated. Shop prime paint for interior exposure or Hot-dip zinc coat according to ASTM A 123/A 123M for exterior or weather exposure.
- C. Furnish ceiling extensions (where indicated), either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface unless otherwise indicated.
- D. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A, carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.
 - 1. Finish: Plain, uncoated.
- E. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 - 1. Finish: Plain.
- F. Welding Electrodes: Comply with AWS standards.
- G. Galvanizing Repair Paint: ASTM A 780.
- H. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.8 CLEANING AND SHOP PAINTING

- A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.
- B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.
- C. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1.5 mil thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Do not install joists until supporting construction is in place and secured.
- B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJ's "Specifications", "Standard Specifications for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice," joist manufacturer's written recommendations, and requirements in this Section.
 - 1. Before installation, splice joists delivered to Project site in more than one piece.
 - 2. Space, adjust, and align joists accurately in location before permanently fastening.
 - 3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
 - 4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.
- C. Field weld joists to supporting steel bearing plates and framework as indicated on Drawings. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance, and quality of welds, and methods used in correcting welding work.
- D. Bolt joists to supporting steel framework using high-strength structural bolts as indicated on Drawings. Comply with Research Council on Structural Connection's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.
- E. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: See Section 01 4523.

3.4 REPAIR AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.
 - 1. Clean and prepare surfaces by hand-tool cleaning according to SSPC-SP 2, or power-tool cleaning according to SSPC-SP 3.
 - 2. Apply a compatible primer of same type as primer used on adjacent surfaces.

- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION

**SECTION 05 3123
STEEL ROOF DECKING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. Roof deck.
 2. Acoustical roof deck.
 3. Noncomposite vented roof deck.
- B. Related Requirements:
1. Section 01 4523 "Structural Testing and Inspection Services"
 2. Section 05 12 00 "Structural Steel Framing".
 3. Section 05 50 00 "Metal Fabrications".

1.3 REFERENCES

- A. Comply with applicable provisions of the following specifications and documents. The latest adopted edition of all standard referenced in this section shall apply, unless noted otherwise.
1. AWS D1.1 – Structural Welding Code
 2. AWS D1.3 – Structural Welding Code – Sheet Steel
 3. SDI – Design Manual
 4. SSPC – Painting Manual
 5. UL – Fire Resistance Directory
 6. ICBO – Product Evaluation Reports
 7. FM – Roof Assembly Classifications
- B. In the case of conflict between the Contract Documents and a referenced standard, the Contract Documents shall govern. In the case of a conflict between the Contract Documents and the Building Code, the more stringent shall govern.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings:
1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Product Certificates: For each type of steel deck.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
 - 1. Power-actuated mechanical fasteners.
 - 2. Acoustical roof deck.
- D. Evaluation Reports: For steel deck.
- E. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Refer Section 01 4523.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."
- C. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
 - 1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

- C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- D. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 ROOF DECK

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ASC Profiles, Inc.; a Blue Scope Steel company.
 - 2. Canam United States; Canam Group Inc.
 - 3. CMC Joist & Deck.
 - 4. Consolidated Systems, Inc.; Metal Dek Group.
 - 5. Cordeck.
 - 6. DACS, Inc.
 - 7. Epic Metals Corporation.
 - 8. Marlyn Steel Decks, Inc.
 - 9. New Millennium Building Systems, LLC.
 - 10. Nucor Corp.; Vulcraft Group.
 - 11. Roof Deck, Inc.
 - 12. Valley Joist; Subsidiary of EBSCO Industries, Inc.
 - 13. Verco Manufacturing Co.
 - 14. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.
- B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
 - 1. Prime-Painted Steel Sheet: ASTM A 1008, Structural Steel (SS), Grade 40 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Manufacturer's standard.
 - 2. Galvanized-Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 40, G90 zinc coating.
 - 3. Galvanized and Shop-Primed Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 40, G60 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Manufacturer's standard.
 - 4. Deck Profile: As indicated on plan.
 - 5. Profile Depth: As indicated on plan.
 - 6. Design Uncoated-Steel Thickness: As indicated in Structural General Notes.
 - 7. Span Condition: Triple span or more.
 - 8. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 ACOUSTICAL ROOF DECK

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ASC Profiles, Inc.; a Blue Scope Steel company.
 - 2. Canam United States; Canam Group Inc.

3. CMC Joist & Deck.
4. Consolidated Systems, Inc.; Metal Dek Group.
5. Cordeck.
6. DACS, Inc.
7. Epic Metals Corporation.
8. Marlyn Steel Decks, Inc.
9. New Millennium Building Systems, LLC.
10. Nucor Corp.; Vulcraft Group.
11. Roof Deck, Inc.
12. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Acoustical Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:

1. Prime-Painted Steel Sheet: ASTM A 1008, Structural Steel (SS), Grade 40 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Manufacturer's standard.
2. Galvanized-Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 40, G60 zinc coating.
3. Deck Profile: As indicated in Structural General Notes.
4. Cellular Deck Profile: As indicated in Structural General Notes.
5. Profile Depth: As indicated in Structural General Notes.
6. Design Uncoated-Steel Thickness: As indicated in Structural General Notes.
7. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated in Structural General Notes.
8. Span Condition: Triple span or more.
9. Side Laps: Overlapped or interlocking seam at Contractor's option.
10. Acoustical Perforations: Deck units with manufacturer's standard perforated vertical webs.
11. Sound-Absorbing Insulation: Manufacturer's standard pre-molded roll or strip of glass or mineral fiber.
 - a. Factory install sound-absorbing insulation into cells of cellular deck.

2.4 NONCOMPOSITE VENTED ROOF DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ASC Profiles, Inc.; a Blue Scope Steel company.
2. Canam United States; Canam Group Inc.
3. CMC Joist & Deck.
4. Consolidated Systems, Inc.; Metal Dek Group.
5. Marlyn Steel Decks, Inc.
6. New Millennium Building Systems, LLC.
7. Nucor Corp.; Vulcraft Group.
8. Roof Deck, Inc.
9. Verco Manufacturing Co.
10. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Noncomposite Vented Roof Deck: Fabricate ribbed- and vented-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 31, and with the following:

1. Galvanized-Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 40, G90 zinc coating.
2. Profile Depth: As indicated in Structural General Notes.
3. Design Uncoated-Steel Thickness: As indicated in Structural General Notes.
4. Span Condition: Triple span or more.
5. Side Laps: Overlapped or interlocking seam at Contractor's option.
6. Vent Slot Area: Manufacturer's standard vent slots providing 1-1/2.

2.5 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth unless otherwise indicated.
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.
- I. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.
- J. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch- wide flanges and sloped recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.
- K. Galvanizing Repair Paint: ASTM A 780.
- L. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.
 - 1. Fasteners shall provide diaphragm shear and uplift resistance equal to or greater than welding indicated herein and on Drawings.

3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
 - 1. Weld Diameter: As indicated on Structural Plans.
 - 2. Weld Spacing: As indicated on Structural Plans.
 - 3. Weld Washers: Install weld washers at each weld location if deck gauge is lighter than 22 gauge.

- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals shown on Structural Plans:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
 - 2. Fasten with a minimum of 1-1/2-inch- long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped 2 inches minimum or butted at Contractor's option.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld or mechanically fasten flanges to top of deck. Space welds or mechanical fasteners not more than 12 inches apart with at least one weld or fastener at each corner.
 - 1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.
 - 1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: See Section 01 4523.
- B. Field welds will be subject to inspection.
- C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
 - 1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
- C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION

**SECTION 05 4000
COLD-FORMED METAL FRAMING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Formed steel stud exterior wall and interior wall framing, both load-bearing and non-load-bearing, including soffit framing and other non-structural miscellaneous framing.
- B. Formed steel joist and purlin framing and bridging.

1.02 RELATED REQUIREMENTS

- A. Section 05 1200 - Structural Steel Framing.
- B. Section 05 3100 - Steel Decking.
- C. Section 06 1000 - Rough Carpentry: Wood blocking and miscellaneous framing.

1.03 REFERENCE STANDARDS

- A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2012.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- D. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2021.
- E. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020.
- F. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- G. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with work of other sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.
- C. Product Data: Provide manufacturer's data on factory-made framing connectors, showing compliance with requirements.
- D. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
 - 1. Indicate stud, floor joist, ceiling joist, roof rafter, and roof truss layout.
 - 2. Describe method for securing studs and all of the cold formed metal framing to tracks and any other boundary supports all framing connections.
 - 3. Design data:

- a. Shop drawing sheets that include engineering information designed by the Contractor's Delegated Design Engineer shall be signed and sealed in accordance with the Texas Engineering Practice Act. Sheets that do not provide information designed by the Contractor's Engineer do not require being signed and sealed. Calculation packages require a signed and sealed cover sheet only. Any submittals requiring to be signed and sealed that are received without the signature and seal will be rejected without review.
- E. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention .

1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Design framing system under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Texas.
- B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum five years of documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

1.07 MOCK-UP

- A. Provide mock-up of exterior framed wall, including components specified elsewhere, such as insulation, sheathing, window frame, door frame, exterior wall finish, and interior wall finish.
- B. Mock-Up Size: 4 by 4 feet, including corner condition.
- C. Location: As directed.
- D. Mock-up may not remain as part of the Work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Framing:
 - 1. CEMCO: www.cemcosteel.com.
 - 2. ClarkDietrich Building Systems: www.clarkdietrich.com.
 - 3. MarinoWARE: www.marinoware.com/#sle.
 - 4. Mill Steel Company: www.millsteel framing.com
 - 5. Telling Industries, LLC: www.buildstrong.com.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. Framing Connectors and Accessories:
 - 1. Same manufacturer as metal framing.
 - 2. Simpson Strong Tie: www.strongtie.com.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FRAMING SYSTEM

- A. Provide primary and secondary framing members, straight and curved track, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.
- B. Design Requirements: Provide completed framing system having the following characteristics:
 - 1. Design: Calculate structural characteristics of cold-formed steel framing members according to AISI S100-12.
 - 2. Structural Performance: Design, engineer, fabricate, and erect to withstand specified design loads for project conditions within required limits.
 - 3. Design Loads: As indicated on the drawings.
 - 4. Wind and Live load deflection meeting the following, unless otherwise indicated:
 - a. Floors: Maximum vertical deflection under live load of 1/360 of span.

- b. Roofs: Maximum vertical deflection under live load of 1/180 over areas without a ceiling, 1/240 over areas with a nonplaster ceiling and 1/360 over areas with a plaster ceiling.
 - c. Interior Walls that have no exposure to exterior wind pressures: Maximum horizontal deflection under interior wind pressures of 1/360 of span.
 - d. Exterior Walls: Maximum horizontal deflection under service level Components and Cladding wind load of 1/600 of span where masonry veneer or plaster is outside of the stud wall and 1/360 of span where metal panel or flexible finishes are outside of the stud wall.
- 5. Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
 - 6. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
- C. Shop fabricate framing system to the greatest extent possible.
 - D. Deliver to site in largest practical sections.

2.03 FRAMING MATERIALS

- A. Studs and Track: ASTM C955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.
 - 1. Gage and depth: Minimum 18 gage thickness for exterior walls, and depth as shown on the drawings. Minimum 25 gage thickness for interior walls, and depth as shown on the drawings. The Cold Formed Metal Framing Engineer may increase the gage and decrease the spacing as required for design but may not increase the depth as shown on the drawings.
 - 2. Galvanized in accordance with ASTM A653/A653M, G60/Z180 coating.
 - 3. Provide components fabricated from ASTM A 1008/A 1008M, Designation SS steel.
- B. Joists and Purlins: Fabricated from ASTM A653/A653M steel sheet, with G60/Z180 hot dipped galvanized coating.
 - 1. Base Metal: Structural Steel (SS), Grade 33/230.
 - 2. Gage and depth: Minimum 18 gage thick, and depth as shown on the drawings. The Cold Formed Metal Framing Engineer may increase the gage and decrease the spacing as required for design but may not increase the depth as shown on the drawings.
- C. Framing Connectors: Factory-made, formed steel sheet.
 - 1. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
 - 2. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, shouldered screws or screws and anti-friction or stepped bushings, while maintaining structural performance of framing. Provide movement connections at the following locations:
 - a. Where continuous studs bypass elevated floor slab, connect stud to slab in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum movement of 1/2 inch.
 - b. Where top of stud wall terminates below structural floor or roof, connect studs to structure in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum movement of 1/2 inch.
 - c. Provide top track with long leg track and head of wall movement connectors; minimum track length of 12 feet.
 - 3. Fixed Connections: Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.

2.04 FASTENERS

- A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.
- B. Anchorage Devices: Powder actuated, Drilled expansion bolts, and Screws with sleeves.
- C. Welding: Comply with AWS D1.1/D1.1M.

2.05 ACCESSORIES

- A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.
- B. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that building framing components are ready to receive work.
- B. Verify field measurements and adjust installation as required.

3.02 INSTALLATION OF STUDS

- A. Install components in accordance with ASTM C1007 requirements and ASTM C1007 requirements.
- B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 24 inches on center. Coordinate installation of sealant with floor and ceiling tracks.
- C. Place studs at 16 inches on center, maximum; not more than 2 inches from abutting walls and at each side of openings. Connect studs to tracks using fastener method.
- D. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.
- E. Install load bearing studs full length in one piece. Splicing of studs is not permitted.
- F. Install load bearing studs, brace, and reinforce to develop full strength and achieve design requirements.
- G. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.
- H. Install intermediate studs above and below openings to align with wall stud spacing.
- I. Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.
- J. Attach cross studs to studs for attachment of fixtures anchored to walls.
- K. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
- L. Touch-up field welds and damaged galvanized surfaces with primer.

3.03 INSTALLATION OF JOISTS AND PURLINS

- A. Install framing components in accordance with manufacturer's instructions.
- B. Make provisions for erection stresses. Provide temporary alignment and bracing.
- C. Place joists at 16 inches on center; not more than 2 inches from abutting walls. Connect joists to supports using fastener method.
- D. Set floor and ceiling joists parallel and level, with lateral bracing and bridging.
- E. Locate joist end bearing directly over load bearing studs or provide load distributing member to top of stud track.

- F. Provide web stiffeners at reaction points.
- G. Touch-up field welds and damaged galvanized surfaces with primer.

3.04 TOLERANCES

- A. Maximum Variation from True Position: 1/4 inch.
- B. Maximum Variation of any Member from Plane: 1/4 inch.

END OF SECTION

**SECTION 05 5000
METAL FABRICATIONS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop fabricated steel items.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.
- B. Section 04 2000 - Unit Masonry: Placement of metal fabrications in masonry.
- C. Section 05 1200 - Structural Steel Framing: Structural steel column anchor bolts.
- D. Section 05 2100 - Steel Joist Framing: Structural joist bearing plates, including anchorage.
- E. Section 05 3100 - Steel Decking: Bearing plates for metal deck bearing, including anchorage.
- F. Section 05 5133 - Metal Ladders.
- G. Section 05 5213 - Pipe and Tube Railings.
- H. Section 09 9000 - Painting and Coating.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.
- F. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021.
- G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.
- I. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2019, with Editorial Revision (2020).
- J. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
- K. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- L. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).
- M. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).
- N. SSPC-SP 2 - Hand Tool Cleaning; 2018.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
-

- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

1.05 QUALITY ASSURANCE

- A. Design miscellaneous steel and iron under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in Texas.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

- A. Steel Sections: Shapes, bar and plate shall conform to ASTM A 36/A 36M. Light gauge structural steel shall conform to ASTM A924, latest revision. All material shall be straight, free from mill scale, rust, pitting and dents that will detract from finished appearance when painted.
- B. Steel Tubing: ASTM A500/A500M Grade B cold-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A 53/A 53M, Grade B Schedule 40, black finish.
- E. Slotted Channel Framing: ASTM A653/A653M, Grade 33.
- F. Slotted Channel Fittings: ASTM A1011/A1011M.
- G. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.
- H. Sheet Metal shall be open hearth, full pickled, cold rolled, annealed, patent leveled, entirely free from scale, waves and other defects.
- I. Bolts, Nuts, and Washers: ASTM F3125/F3125M, galvanized to ASTM A153/A153M where connecting galvanized components.
- J. Rivets shall conform to ASTM A-141, latest revision.
- K. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- L. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- M. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

- A. All workmanship must be first-class in all respects and any members not presenting a finished and workmanlike appearance will be rejected. All finished members shall be free from twists, bends and open joints. Work shall conform to all applicable requirement of AISC.
- B. All members shall be true to length so that assembly may be done without fillers, except where same are required as detailed. There shall be no projecting edges or corners where different members are assembled. On exposed surfaces, welds shall be ground smooth and flush with parent metal. All coping, blocking or mitering shall be done with care. Sharp edges and corners caused by shearing or other tooling shall be eased where exposed.

- C. All details and connections shall be close fitting and carefully made and fitted, and special care shall be exercised to produce a thoroughly neat and workmanlike appearance. All detail pieces shall be made in exact accordance with Detail Drawings with all projecting corners clipped and all filler pieces made flush. Provide all lugs, clips, connections, bolts, etc., necessary to complete fabrication and erection.
- D. Unless otherwise shown on Drawings, all bolts remaining in the finished, exposed work shall have countersunk heads; nuts shall be hexagonal. Bolts shall be of proper length to permit full thread in the nut, but shall not project more than 1/4" beyond the face of the nut. Screws shall be countersunk Phillips head.
- E. The Contractor shall provide all holes in his work required for the connection of the work of other trades.
- F. There shall be no flame cutting of members in the field without the consent of the Architect. If consent is given, burned flame cut members shall be finished to an acceptable appearance that shall be equal of a sheared finish.
- G. Burning shapes to length in the shop with a standard flame cutting machine will be permitted. Burning of holes will NOT be permitted in the shop or in the field.
- H. Anchors for frames, floor angles and other miscellaneous iron members shown anchored into concrete or masonry shall be strap iron, bent to shape, or deformed bent bars welded to backs of members, extended with bent end for building in as conditions required and of sizes and spacing as noted. Where the size and spacing are not noted, anchors shall not be less than 1-1/2" x 1/4" for concrete and 1-1/2" x 1/8" for masonry to fit the jointing of the adjacent brick or masonry block work. Unless otherwise noted on the Drawings, anchors shall be spaced 3'-0" or less o.c.
- I. Where anchors and plates or clips are to be built in for attachment of later work, bolts shall be placed in the plates or clips and welded to back with threaded ends extended as required.
- J. For attaching work to masonry or concrete, where anchors or inserts cannot be built-in, provide approved type of cinch anchors and machine bolts or screws. Holes shall be accurately drilled.
- K. Fit and shop assemble items in largest practical sections, for delivery to site.
- L. Fabricate items with joints tightly fitted and secured.
- M. Continuously seal joined members by intermittent welds and plastic filler.
- N. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- O. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- P. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

- A. Bollards: Steel pipe, concrete filled, prefabricated or hand formed crowned cap, or as detailed; prime paint finish.
- B. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking, joists, and masonry; prime paint finish.
- C. Lintels: As detailed; prime paint finish.
- D. Door Frames for Overhead Door Openings and Wall Openings: Channel and Angle sections; prime paint finish.
- E. Elevator Hoistway Divider Beams: Beam sections; prime paint finish.

2.04 FINISHES - STEEL

- A. Prime paint steel items.
 - 1. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.
- E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.
- F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.
- G. All steel exposed to weather, set in concrete shall be painted with cold galvanized zinc, specification of U.S. Navy MIL-P-21035, U.S. Air Force MIL-P-26915A, equal to Hot Dip galvanized in cathodic protection.

2.05 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

- A. The Contractor shall examine the construction to which his work is to be applied and shall notify the Architect in writing if deficiencies exist which are detrimental to the proper and timely installation of any work required under this section.

3.02 PREPARATION

- A. The contractor shall examine the drawings and specifications with respect to the work shown or required under this section and related sections so as to insure the completeness of all work.
Supplementary parts necessary to complete each item of miscellaneous iron and steel required under this section, such as bent plates, beams, columns, sleeves, clips, brackets, hangers, anchors, bolts and other fastenings and supports, though such parts are not shown on drawings or specified herein, shall be included.
- B. The Contractor shall coordinate and schedule the work of this section with the work of other trades. Anchors, sleeves, framing, fastenings and other miscellaneous items to be embedded in concrete or masonry or required for securing miscellaneous iron and steel work to other construction, shall be furnished as required and so as not to delay the progress of the work.
- C. The Contractor shall obtain field measurements of adjoining work as required to locate and fit the work of this section. He will be held responsible for the accurate fitting of his material to the building.
- D. Storage and Handling: Miscellaneous steel shall be handled and delivered to the job in a manner that will prevent damage to the material. Store in a dry place, under cover, well protected from weather and all elements that will cause deterioration.
- E. Clean and strip primed steel items to bare metal where site welding is required.
- F. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects. All parts shall be secured in a rigid and substantial manner and methods of attachment shall be concealed wherever practicable.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components as indicated.
- D. Perform field welding in accordance with AWS D1.1/D1.1M.
- E. Obtain approval prior to site cutting or making adjustments not scheduled.
- F. After erection, prime welds, abrasions and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.
- G. Other trades will set and build in items of miscellaneous iron which are to be built into masonry or concrete, such as loose lintels, seat angles, door frames, curbs, sleeve inserts, brackets, lugs, anchors, etc. as required to complete all parts of the work.
- H. All such items shall be fabricated and delivered by the miscellaneous iron trade, complete with bolts, anchors, clips, etc., ready for the other trades to set. This trade shall consult with the trades concerned and make delivery to the points designated by the latter to expedite the installation of delivered materials in their current locations and shall furnish setting drawings where required.
- I. Where frames, curbs, and similar work are composed of several parts, only those parts upon which anchors occur will, unless otherwise specified, be set and built-in by the other trades ready to receive further field assembly by the miscellaneous iron contractor.
- J. Where necessary to secure miscellaneous iron work to the structure by means of welding, expansion bolts, cinch anchors and similar connections, this trade shall, unless otherwise specified, do the work of laying out and installing such connections, installing the miscellaneous iron work and bolting up.
- K. All other items of miscellaneous iron shall be furnished and completely installed and connections made by this trade.
- L. Throughout the work of this trade, anchors and inserts shall be provided wherever possible for building in the adjoining work. Where lugs are shown or specified for building into adjoining masonry, the parts having lugs shall be erected in place before the masonry is built. Elsewhere, the work shall be brought to the building in as large pieces as practicable and attached to anchors or inserts during erection.
- M. All parts of work exposed to view shall be left clean, smooth and neatly finished.
- N. All freestanding steel handrails shall be embedded in the concrete slab unless noted otherwise.
- O. Shelf angles and supports for masonry, etc., and slab edge plates shall be furnished and installed as shown.
- P. All shelf angles shall be punched for bolts. Furnish and install bolts as required.

3.04 WELDING

- A. All welding on steel, both shop and field, shall be done by the electric method in accordance with the American Welding Society specifications. Welder shall be especially skilled in this class of work and qualified by successfully passing the American Welding Society tests and have a current certificate.

- B. Welds shall be solid and homogeneously a part of the metals joined and free from pits or incorporated slag and scale. Surfaces of welds shall be smooth and regular and shall be full area indicated or required to develop the required strength of the joints. Where exposed, welds shall be ground smooth and flush with the parent metal, so as to be imperceptible after painting.
- C. If directed by Architect, welds, selected at random, shall be tested by an approved laboratory and any welds not complying with the specifications shall be removed and replaced with satisfactory work. The cost of test shall be borne by the Contractor in all cases in which welding fails to comply with the specifications, otherwise by Owner. The cost of replacing condemned welds, plus the cost of replacing other materials damaged incidental thereto, shall be borne by the Contractor.
- D. Galvaweld: All welds on galvanized surfaces performed after galvanizing shall be Galvaweld coated.

3.05 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

**SECTION 05 5133
METAL LADDERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop-fabricated metal ladders.

1.02 RELATED REQUIREMENTS

- A. Section 05 5000 - Metal Fabrications
- B. Section 09 9000 - Painting and Coating

1.03 REFERENCE STANDARDS

- A. 29 CFR 1910.23 - Ladders; current edition.
- B. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008.
- C. ANSI/ASSP Z359.11 - Safety Requirements for Full Body Harnesses; 2014.
- D. ANSI/ASSP Z359.12 - Connecting Components for Personal Fall Arrest Systems; 2009.
- E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- F. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- G. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- H. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- I. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.
- J. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021.
- K. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2019, with Editorial Revision (2020).
- L. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
- M. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- N. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).
- O. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).
- P. SSPC-SP 2 - Hand Tool Cleaning; 2018.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 2. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

- C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

1.05 QUALITY ASSURANCE

- A. Design miscellaneous steel and iron under direct supervision of a Professional Engineer experienced in design of this work and licensed in Texas.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A500/A500M Grade B cold-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- E. Mechanical Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.
- F. Bolts, Nuts, and Washers: ASTM F3125/F3125M, galvanized to ASTM A153/A153M where connecting galvanized components.
- G. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- H. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- I. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Continuously seal joined members by intermittent welds and plastic filler.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED LADDERS

- A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; galvanized finish.
 - 1. Side Rails: 3/8 by 2 inches members spaced at 20 inches.
 - 2. Rungs: One inch diameter solid round bar spaced 12 inches on center.
 - 3. Space rungs 7 inches from wall surface.
 - 4. Comply with 29 CFR 1910.28 for fixed ladders that extend more than 24 feet above a lower level.
 - 5. Provide ladders at elevator pit, roof hatch, floor hatch and roof-to-roof ladders where noted on the drawings or where required by code.

2.04 FINISHES - STEEL

- A. Prime paint steel items.
 - 1. Do not prime surfaces in direct contact with concrete.

2. Do not prime surfaces where field welding is required.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.
- E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.
- F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.05 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components as indicated.
- D. Perform field welding in accordance with AWS D1.1/D1.1M.
- E. Obtain approval prior to site cutting or making adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

**SECTION 06 1000
ROUGH CARPENTRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-structural dimension lumber framing.
- B. Sheathing.
- C. Roofing nailers.
- D. Roofing cant strips.
- E. Preservative treated wood materials.
- F. Fire retardant treated wood materials.
- G. Miscellaneous framing and sheathing.
- H. Concealed wood blocking, nailers, and supports.
- I. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

- A. Section 05 1200 - Structural Steel Framing: Prefabricated beams and columns for support of wood framing.
- B. Section 05 5000 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.
- C. Section 07 2500 - Weather Barriers
- D. Section 07 7200 - Roof Accessories: Prefabricated roof curbs.

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- C. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010 (Reapproved 2017).
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- E. AWPA U1 - Use Category System: User Specification for Treated Wood; 2022.
- F. PS 1 - Structural Plywood; 2019.
- G. PS 2 - Performance Standard for Wood-Based Structural-Use Panels; 2010.
- H. PS 20 - American Softwood Lumber Standard; 2020.
- I. SPIB (GR) - Grading Rules; 2014.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide technical data on insulated sheathing, wood preservative materials, application instructions, and vendor.
- C. Samples: For rough carpentry members that will be exposed to view, submit three samples, 12by12 inch in size illustrating wood grain, color, and general appearance.
- D. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
 - 1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.
 - 2. Identify plywood sheathing as to grade, use, span rating and exposure classification by the mark of the APA The Engineered Wood Association.
 - 3. Use extreme care when off-loading lumber to prevent damage, splitting and breaking of materials. Split or broken plywood sheathing will not be accepted for use in the work of this Section.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. Species: Spruce-Pine-Fir (South), unless otherwise indicated.
 - 2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
 - 3. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

2.02 DIMENSION LUMBER

- A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: 19 percent maximum.
- D. Stud Framing (2 by 2 through 2 by 6):
 - 1. Species: Any allowed under referenced grading rules.
 - 2. Grade: No. 2.
- E. Joist and Rafter Framing (2 by 6 through 4 by 16):
 - 1. Species: Spruce-Pine-Fir (South).
 - 2. Grade: No. 2.
- F. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 2 or Standard Grade.
 - 2. Boards: No. 2 or Standard Grade.

2.03 EXPOSED BOARDS

- A. Submit manufacturer's certificate that products meet or exceed specified requirements, in lieu of grade stamping.
- B. Moisture Content: S-dry (19 percent maximum).
- C. Surfacing: S4S.
- D. Species: Douglas Fir.
- E. Grade: No. 2, 2 Common, or Construction.

2.04 CONSTRUCTION PANELS

- A. Roof Sheathing: Any PS 2 type, rated Structural I Sheathing.
 - 1. Bond Classification: Exposure 1.

2. Span Rating: 40/20.
 3. Thickness: 5/8 inch, nominal for standing seam metal roofs, 2 layers of 3/8 inch, nominal for curved standing seam metal roofs and 3/4 inch for asphalt shingle roofs.
 4. Provide metal clip supports between sheets
- B. Other Applications: Thickness as noted on the drawings
1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
 2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
 3. Other Locations: PS 1, C-D Plugged or better.

2.05 ACCESSORIES

- A. Fasteners and Anchors:
1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, stainless steel for fire retardant treated locations, unfinished steel elsewhere.
 2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
 3. Anchors: Expansion shield and lag bolt type for anchorage to solid masonry or concrete.
- B. Fasteners at Roof Nailers:
1. Wood Substrate: #10 stainless steel flat head screws, length as necessary to penetrate underlying wood support members a minimum of 1 1/4 inch. Each fastener to have a minimum pull out resistance of 100 pounds.
 - a. Bent plate for attaching vertical lumber at curbs: 18 gauge galvanized steel (G90) bent plate, fastened with stainless steel pancake head screws.
 2. Metal Substrate: No. 12 Factory Mutual approved, fluorocarbon coated roofing screw.
 3. Concrete or masonry surfaces: Series 400 stainless steel anchor with expansion shank, length as recommended by manufacturer for minimum 1,000 pound pull-out resistance.
 4. Lightweight Fill Substrate: OMG Lite-Deck Fasteners (or approved equivalent) #TSFQ4, minimum length sufficient to provide manufacturer's minimum embedment into substrate for published resistances.
 - a. Shank diameter 0.312" minimum, thread diameter of 0.375" minimum.
 - b. Fastener shall be coated with a corrosion resistant coating. When subjected to 30 Kesternich cycles (DIN 50018), the fastener must show less than 15% red rust and surpass Factory Mutual Approval Standard 4470.
- C. Die-Stamped Connectors: Hot dipped galvanized steel, sized to suit framing conditions.
1. For contact with preservative treated wood in exposed locations, provide minimum G185 galvanizing complying with ASTM A653/A653M.
- D. Joist Hangers: Hot dipped galvanized steel, sized to suit framing conditions.
1. For contact with preservative treated wood in exposed locations, provide minimum G185 galvanizing complying with ASTM A653/A653M.
- E. Water-Resistive Barrier: As specified in Section 07 2500.

2.06 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
 2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

- B. Fire Retardant Treatment:
1. Exterior Type: AWWA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
 - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - b. Treat all exterior rough carpentry items.
 - c. Do not use treated wood in direct contact with the ground.
 2. Interior Type A: AWWA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
 - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - b. Treat rough carpentry items as indicated .
 - c. Do not use treated wood in applications exposed to weather or where the wood may become wet.
- C. Preservative Treatment:
1. Preservative Pressure Treatment of Lumber Above Grade: AWWA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
 - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - b. Treat lumber exposed to weather.
 - c. Treat lumber in contact with roofing, flashing, or waterproofing.
 - d. Treat lumber in contact with masonry or concrete.
 - e. Treat lumber in other locations as indicated.
 2. Preservative Pressure Treatment of Plywood Above Grade: AWWA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative.
 - a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
 - b. Treat plywood in contact with roofing, flashing, or waterproofing.
 - c. Treat plywood in contact with masonry or concrete.
 - d. Treat plywood in other locations as indicated.
 3. Preservative Pressure Treatment of Lumber in Contact with Soil: AWWA U1, Use Category UC4A, Commodity Specification A using waterborne preservative.
 - a. Preservative for Field Application to Cut Surfaces: As recommended by manufacturer of factory treatment chemicals for brush-application in the field.
 - b. Restrictions: Do not use lumber or plywood treated with chromated copper arsenate (CCA) in exposed exterior applications subject to leaching.

PART 3 EXECUTION

3.01 PREPARATION

- A. Where wood framing bears on cementitious foundations, install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of 4 inches and seal.
- B. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.
- C. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.

- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 FRAMING INSTALLATION

- A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength.
- B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.
- C. Install structural members full length without splices.
- D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes.
- E. Install horizontal spanning members with crown edge up and not less than 3 inches of bearing at each end.
- F. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.
- G. Provide bridging at joists in excess of 8 feet span at mid-span. Fit solid blocking at ends of members.
- H. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.04 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.
- C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- F. Provide the following specific non-structural framing and blocking:
 - 1. Cabinets and shelf supports.
 - 2. Wall brackets.
 - 3. Handrails.
 - 4. Grab bars.
 - 5. Towel and bath accessories.
 - 6. Wall-mounted door stops.
 - 7. Chalkboards and marker boards.
 - 8. Wall paneling and trim.
 - 9. Joints of rigid wall coverings that occur between studs.

3.05 ROOF-RELATED CARPENTRY

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
- B. Provide wood curb at all roof openings except where prefabricated curbs are specified and where specifically indicated otherwise. Form corners by alternating lapping side members.
 - 1. Install new wood where indicated to provide total height of a minimum of 12 inches above the finished roof surface, allowing for height of insulation system, crickets, and coverboard, as applicable.
 - 2. Fasten securely to substrate.
 - 3. Treat surfaces exposed by cutting as recommended by preservative manufacturer.
 - 4. Fasten wood curb to nailer prior to installation with appropriate wood nailer fastener on 12-inch centers.
- C. Secure all roof nailers at copings and edges with two staggered rows of fasteners, spaced 12" o.c. maximum at wood or light gauge steel substrates, and 24" o.c. maximum at concrete, grouted masonry, or structural steel substrates.

3.06 INSTALLATION OF CONSTRUCTION PANELS

- A. General: Comply with applicable recommendations contained in APA Form No. E30, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.
 - 1. Comply with "Code Plus" provisions of above-referenced guide.
- B. Comply with system manufacturer's written instructions for installing plywood.
 - 1. Install plywood sheathing continuously, with the strength of the axis of the panel across supports. Plywood sheathing shall be installed with offset joints. Butt end joints over supports, providing a space of 1/16" at panel ends and 1/8" at panel edges.
 - 2. Fasten each layer of plywood sheathing using #13-14 Dekfast screws with Phillips drive truss heads in a noncorrosive base material in sufficient length to penetrate the metal decking by 1/2". Use a screw pattern of 6" spacing along exterior edges and a 12" interior grid pattern per UL90 class 580 uplift. Provide a minimum of 32 fasteners per sheet. Plywood shall be fastened as an independent system for the insulation. Where drawings indicate multiple layers of plywood, stagger second layer in both directions from pattern below. At curved roof structures, plywood shall conform to the radius of the structure.
 - 3. Within 40 feet in any direction of any 4-hour firewall, install fire-retardant treated plywood sheathing.
 - 4. Provide metal clip supports between sheets at center spans unless tongue and groove plywood sheathing is used.
 - 5. Cover plywood sheathing as soon as possible with specified underlayment for protection against excessive moisture prior to roofing application.
 - 6. Do not install plywood sheathing in adverse weather conditions. Plywood sheathing may be rejected by the Architect, whether or not it has been installed, for excessive warp, twist, crook, mildew, fungus, or mold as well as for improper curing and firming prior to installation. Wet or damaged plywood sheathing will be rejected.

3.07 SITE APPLIED WOOD TREATMENT

- A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.
- B. Allow preservative to dry prior to erecting members.

3.08 TOLERANCES

- A. Framing Members: 1/8 inch from true position, maximum.
- B. Surface Flatness of Floor: 1/8 inch in 10 feet maximum, and 3/8 inch in 30 feet maximum.

- C. Variation from Plane (Other than Floors): 1/8 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.09 CLEANING

- A. Waste Disposal: Comply with the requirements of Section 01 7000.
 - 1. Comply with applicable regulations.
 - 2. Do not burn scrap on project site.
- B. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

**SECTION 06 2000
FINISH CARPENTRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Finish carpentry items.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 08 1416 - Flush Wood Doors.
- C. Section 09 9000 - Painting and Coating: Painting and finishing of finish carpentry items.

1.03 REFERENCE STANDARDS

- A. ANSI A135.4 - Basic Hardboard; 2012 (Reaffirmed 2020).
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 4.0; 2021.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.
- B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data:
 - 1. Provide data on fire retardant treatment materials and application instructions.
 - 2. Provide instructions for finish hardware.
- C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
 - 2. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
- D. Samples: Submit two samples of finish plywood, 6 by 6 inch in size illustrating wood grain and specified finish.
- E. Samples: Submit two samples of wood trim 6 inches long.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
 - 1. Company with at least one project within the past 5 years with value of woodwork within 20 percent of cost of woodwork for this project.
 - 2. Single Source Responsibility: Provide and install this work from single fabricator.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-fabricated units to project site in original packages, containers or bundles bearing brand name and identification.
- B. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.
- C. Protect from moisture damage.

- D. Handle materials and products to prevent damage to edges, ends, or surfaces.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

- A. Quality Standard: Premium Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.
- B. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.
- C. Interior Woodwork Items:
 - 1. Moldings, Bases, Casings, and Miscellaneous Trim: As detailed on the drawings.

2.02 LUMBER MATERIALS

- A. Hardwood Lumber: As noted on the drawings, with a maximum moisture content of 6 percent, of quality suitable for transparent finish.

2.03 SHEET MATERIALS

- A. Hardwood Plywood: Face species as indicated, plain sawn, book matched, veneer core, glue type as recommended for application.
- B. Hardboard: ANSI A135.4; Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick, smooth one side (S1S).
- C. Pegboard: Pressed wood fiber with resin binder, standard grade; 1/4 inch thick, with holes spaced at 1 inch on center in both directions.

2.04 FASTENINGS

- A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.
- B. Fastening:
 - 1. Install items straight, true, level, plumb, and firmly anchored in place.
 - 2. Where blocking or backing is required, coordinate as necessary with other trades to ensure placement of required backing and blocking in a timely manner.
 - 3. Nail trim with finish nails of proper dimension to hold the member firmly in place without splitting the wood.
 - 4. Nail exterior trim with galvanized nails, making joints to exclude water and setting in waterproof glue or the sealant described in Section 07 9200 - Joint Sealants of these Specifications.

2.05 FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. Apply wood filler in exposed nail and screw indentations.
- C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.
- D. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and Section 09 9000-Painting and Coating.
- E. Back prime woodwork items to be field finished, prior to installation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

- A. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.
- B. Set and secure materials and components in place, plumb and level.
- C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.
- D. Install components with nails at 8 inch on center.

3.03 PREPARATION FOR SITE FINISHING

- A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.
- B. Site Finishing: See Section 09 9000.
- C. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.04 TOLERANCES

- A. Maximum Variation from True Position: 1/16 inch.
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

**SECTION 07 2100
THERMAL INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation at masonry cavity wall construction and exterior wall behind masonry veneer, MCM and metal panel wall finish.
- B. Batt insulation in exterior wall construction.
- C. Semi-Rigid Board/Blanket insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.
- D. Acoustical batt insulation for interior walls and above ceilings.
- E. Mineral wool insulation for fire safing.

1.02 RELATED REQUIREMENTS

- A. Section 07 2200 - Roof and Deck Insulation: Insulation specified as part of roofing system.
- B. Section 07 8400 - Firestopping: Insulation as part of fire-rated through-penetration assemblies.
- C. Section 09 2982 – Gypsum Board.
- D. Section 09 5100 – Acoustical Ceilings.

1.03 REFERENCE STANDARDS

- A. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).
- B. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).
- C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2017.
- D. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- F. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C; 2019a.
- G. BIA - The Brick Industry Association; Tech Note on Brick Construction, 28B Revised II.
- H. ICC (IECC) - International Energy Conservation Code 2015.
- I. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2019.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements. Provide documentation that proposed insulation has been successfully tested per NFPA 285 with each specific exterior wall assembly for the project. Provide documentation of required detailing for proposed insulation board at openings in the exterior walls to comply with NFPA 285 requirements.
- D. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

- E. Closeout Submittals:
 - 1. Submit under provisions of Section 01 7800 – Closeout Submittals
 - 2. Submit Material Safety Data Sheets under provisions of Section 01 7800 – Closeout Procedures for the following items:
 - a. All mastics, glues, and adhesives.
 - b. Thermal insulation (excluding fiberglass, foam, rubber).

1.05 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 FOAM BOARD INSULATION MATERIALS

- A. Polyisocyanurate (ISO) Board Insulation with Facers Both Sides, installed on masonry wall, behind MCM or metal wall panels where indicated: Rigid cellular foam, complying with ASTM C1289; Type I, aluminum foil both faces; Class 1 or 2.
 - 1. Classifications:
 - a. Type I: Faced with aluminum foil on both major surfaces of core foam.
 - 1) Class 1 or Class 2 - Glass fiber reinforced or non-reinforced core foam.
 - 2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
 - 3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
 - 4. Complies with fire resistance requirements indicated on drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
 - 5. Compressive Strength: 25 psi at vertical locations.
 - 6. Board Size: 48 by 96 inch, cut to fit locations indicated. Thickness as noted on the drawings.
 - 7. Thermal Resistance: R-value of 6.0 per inch, minimum.
 - 8. Board Edges: As tested to be in compliance with NFPA 285.
 - 9. Manufacturers:
 - a. Atlas Roofing Corporation: www.atlasroofing.com/sle.
 - b. Carlisle Coatings & Waterproofing, Inc: www.carlisleccw.com/sle.
 - c. Dow Chemical Company: www.dow.com/sle.
 - d. Firestone Building Products: www.firestonebpco.com.
 - e. GAF: www.gaf.com/sle.
 - f. Hunter Panels, LLC: www.hunterxci.com.
 - g. Johns Manville: www.jm.com/sle.
 - h. Ox Engineered Products: www.oxengineeredproducts.com/#sle.
 - i. Rmax Inc: www.rmax.com.
 - j. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIBERBOARD INSULATION MATERIALS

- A. Glass Fiber Semi-Rigid Board/Blanket Insulation: Low density board, in accordance with ASTM C553, Type III.
 - 1. Provide in shim spaces, crevices in exterior wall/roof and expansion joints as detailed on the drawings.
 - 2. Facing: None, unfaced.
 - 3. Flame Spread Index: 25 or less, when tested with facing, if any, in accordance with ASTM E84.
 - 4. Smoke Developed Index: 50 or less, when tested with facing, if any, in accordance with ASTM E84.
 - 5. Board Size: 24 by 48 inch.
 - 6. Board Thickness: 1 inch.

7. Board Edges: Square.
8. Maximum Density: 1.6 pounds per cubic foot, nominal.
9. Manufacturers:
 - a. CertainTeed Corporation: www.certainteed.com.
 - b. Johns Manville: www.jm.com.
 - c. Knauf Insulation: www.knaufnorthamerica.com
 - d. Owens Corning Corporation: www.ocbuildingspec.com.
 - e. Substitutions: See Section 01 6000 - Product Requirements.

2.03 BATT INSULATION MATERIALS

- A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
 2. Smoke Developed Index: 50 or less, when tested in accordance with ASTM E84.
 3. Combustibility: Non-combustible, when tested in accordance with ASTM E136.
 4. Formaldehyde Content: Zero.
 5. Thermal Resistance: R-value of 11.0 at 3.5" and 19.0 at 6".
 6. Facing: Unfaced.
 7. Manufacturers:
 - a. CertainTeed Corporation: www.certainteed.com.
 - b. Johns Manville: www.jm.com.
 - c. Knauf Insulation: www.knaufnorthamerica.com
 - d. Owens Corning Corporation: www.ocbuildingspec.com/sle.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
- B. Acoustical Batt Insulation:
 1. Provide sound attenuation batts within interior walls and above ceilings, where indicated.
 2. Glass fiber composition, unfaced.
 - a. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
 - b. Smoke Developed Index: 50 or less, when tested in accordance with ASTM E84.
 - c. Thickness: 3.5 or 6 inch, nominal for given location.
 - d. Facing: Unfaced.
 3. Manufacturers:
 - a. CertainTeed Corporation: www.certainteed.com.
 - b. Johns Manville: www.jm.com.
 - c. Knauf Insulation: www.knaufnorthamerica.com.
 - d. Owens Corning Corporation: www.ocbuildingspec.com.
 - e. Substitutions: See Section 01 6000 - Product Requirements.

2.04 FIRE SAFING INSULATION

- A. Mineral Fiber Batt Insulation (Mineral Wool): Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
 1. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
 2. Where indicated or required, provide as fire safing of through penetrations, joint systems and perimeter containment in rated assemblies.
 3. Size and Density: As required to prevent passage of fire between floors or through walls for rating stated.
 4. Manufacturers:
 - a. Johns Manville: www.jm.com/#sle.
 - b. ROCKWOOL (ROXUL, Inc): www.rockwool.com/#sle.
 - c. Thermafiber, Inc: www.thermafiber.com/#sle.
 - d. Substitutions: See Section 01 6000 - Product Requirements.

2.05 ACCESSORIES

- A. Air Barrier Sheet or Air Barrier Coating: See Section 07 2500.
- B. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit application, prohibited for use with foam or high density rigid mineral fiber insulation boards.
- C. Insulation Pins: Insulation manufacturer's standard stainless steel pins with perforated plates, intended for installation in adhesive.
- D. Adhesive: Type recommended by insulation manufacturer for application.
 - 1. Adhesives used to attach exterior insulation to air barrier shall be approved by air barrier manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT EXTERIOR WALLS

- A. Install Iboard insulation on masonry walls, behind MCM or Metal Wall Panels in accordance with fire resistance requirements shown on the drawings and as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
 - 1. Protect edges at door and window openings or other penetrations as tested in accordance with NFPA 285.
 - 2. Blind fastening of insulation through the air/weather barrier is prohibited. Securement of installation boards shall be provided with adhesives or furring installed at the air/weather barrier surface prior to installation of boards.
- B. Install boards vertically on walls.
 - 1. Place boards to maximize adhesive contact.
 - 2. Butt edges and ends tightly to adjacent boards and protrusions. Stagger board joints.
- C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BOARD INSTALLATION AT CAVITY WALLS

- A. Install boards to fit snugly between wall ties.
- B. Install boards vertically on walls.
 - 1. Place boards to maximize adhesive contact.
 - 2. Butt edges and ends tightly to adjacent boards and protrusions. Stagger board joints.
- C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.04 BATT INSTALLATION

- A. Install insulation in accordance with manufacturer's instructions.
- B. Install in exterior wall spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
- E. Wall Sound Insulation: Install Insulation in all metal stud walls unless noted otherwise. Where wall continue to deck, provide sound insulation full height of wall. Do not install insulation between studs where plumbing lines occur.
- F. Ceiling Sound Insulation: Install above the entirety of all offices, restrooms, and workrooms and any other areas defined on the drawings.

G. Coordinate work of this section with construction of air barrier seal specified in Section 07 2500.

3.05 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

**SECTION 07 2500
WEATHER BARRIERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, joints around frames of openings in exterior walls, and joints at base of wall.
- B. Membrane Through Wall Flashings: Self-adhered membrane flashings that comprise part of the air barrier system, intended by the air barrier manufacturer for use in masonry veneer wall construction.

1.02 RELATED REQUIREMENTS

- A. Section 03 1119 - Insulating Concrete Forming
- B. Section 04 2000 - Unit Masonry: Coordination of through wall flashing and masonry ties.
- C. Section 07 6200 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with weather barriers.
- D. Section 07 9200 - Joint Sealants: Sealing building expansion joints.

1.03 DEFINITIONS

- A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.
- B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.

1.04 REFERENCE STANDARDS

- A. ASTM C297/C297M - Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions; 2016.
- B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2017.
- C. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers; 2017.
- D. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies; 2017.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- F. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).
- G. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.
- H. ICC-ES AC212 - Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing; 2015.
- I. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2019.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Preinstallation conference shall include the Architect, General Contractor, Manufacturer's Representative and Applicator. Agenda for meeting shall include but not be limited to the following:
 - 1. Review of submittals.
 - 2. Review of surface preparation, minimum curing period and installation procedures.
 - 3. Review of special details and flashings.
 - 4. Sequence of construction, responsibilities and schedule for subsequent operations.
 - 5. Review of mock-up requirements.
 - 6. Review of inspection, testing, protection and repair procedures.
- B. Coordination of trades
 - 1. The Architect, General Contractor and Applicator shall evaluate adjacent materials such as windows, doors, etc. for conformance to project details. Adjacent trades shall provide scaled shop drawings for review by the Architect.
 - 2. The General Contractor shall make provision for installation of air seals between the primary air barrier and other wall components (penetrations, etc.) in order to maintain continuity of an air barrier system.
 - 3. The Applicator shall provide protection of rough openings before installing windows, doors, and other penetrations through the wall.

1.06 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on material characteristics, performance criteria, and limitations.
- C. Shop Drawings: Provide drawings of special joint conditions.
- D. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.
- E. Air/water-resistive barrier membrane manufacturer shall provide an ICC-ES Evaluation Report confirming compliance with AC212 Acceptance Criteria for Water-Resistive Coatings used as Water-Resistive Barriers over Exterior Sheathing or Masonry or ICF.
- F. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.
- G. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification; keep copies of each contractor accreditation and installer certification on site during and after installation, and present on-site documentation upon request.

1.07 QUALITY ASSURANCE

- A. Air Barrier Association of America (ABAA) Evaluated Materials Program; www.airbarrier.org/#sle: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience and approved by manufacturer. Air barrier Subcontractor(s) shall be accredited minimum of three years at the time of bidding and during the complete installation period by the Air Barrier Association of America (ABAA).
- C. Components used in this section shall be sourced from one manufacturer, including membrane, air barrier sealants, primers, mastics, self-adhered flashings and adhesives as listed and approved as an evaluated air barrier assembly by the Air Barrier Association of America.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the job site in undamaged and original packaging indicating the name of the manufacturer and product.
- B. All pail goods shall bear the ABAA Evaluated Air Barrier label
- C. Store roll materials on end in original packaging.
- D. Keep all products stored at above 40°F. Apply to a substrate with a surface T°F of 40°F and rising. DO NOT ALLOW PRODUCT TO FREEZE.
- E. Protect rolls from direct sunlight until ready for use.
- F. Do not double stack pail goods.

1.09 MOCK-UP

- A. Mockups: Before beginning installation of air/water-resistive barrier, provide air/water-resistive barrier work for exterior wall assembly mockups, incorporating backup wall construction, external cladding, window, door frame and sill, insulation, roof tie-in and flashing to demonstrate surface preparation, crack and joint treatment, and sealing of gaps, terminations, and penetrations of air barrier membrane.
 - 1. Coordinate construction of mockup to permit inspection by Owner's testing agency of air/water-resistive barrier before external insulation and cladding is installed.
 - 2. If Architect determines mockups do not comply with project requirements, reconstruct mockups and apply air/water-resistive barrier until mockups are approved.
 - 3. Contractor shall provide an in-place mockup of each type of expansion joint transitions between air barrier and roofing systems, and at angle changes, prior to proceeding with this work. Failure to provide mockup for review and approval will result in required removal of cladding as required to allow observation by A/E.
- B. Install air barrier materials in mock-up specified in Section 04 2000.
- C. Provide air/water leakage testing for air barrier materials and flashings located at mockup window systems per Division 8 Sections.

1.10 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

1.11 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide manufacturers 10 year material warranty.
 - 1. Ensure all manufacturers installation guidelines, specifications, details and warranty requirements are met.
 - 2. Warranty period shall be 10 years from date of substantial completion.

PART 2 PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

- A. General: Air/water-resistive barrier shall be capable of performing as a continuous vapor-permeable air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. At wall cladding transitions, the air/water-resistive barrier shall form a continuous air barrier and shall make provision for water drainage, either by creation of an unobstructed drainage plane that extends across the cladding transition or by flashing to discharge to the exterior at the transition. Air barrier assemblies shall be capable of accommodating substrate movement and sealing substrate expansion and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits, or interruption of the drainage plane.

- B. Air Barrier shall be compatible with glass-mat faced gypsum, masonry and expanded polystyrene (ICF) wall systems.
- C. The weather barrier assembly, including but not limited to, fluid applied air/water-resistive barrier membrane, sheathing fabric, transition membrane and flashing primer shall be obtained or approved as a single-source from the membrane manufacturer to ensure system compatibility and integrity.
- D. Air Barrier:
 - 1. On outside surface of inside wythe of exterior masonry cavity walls use air barrier coating on wall surface and related thru-wall flashings, flashings for rough openings, windows, doors, base flashings and terminations to the roof.
 - 2. On outside surface of sheathing of exterior walls use air barrier coating on wall surface and related thru-wall flashings, flashings for rough openings, windows, doors, base flashings and terminations to the roof.
 - 3. On outside surface of ICF wall systems use air barrier coating on wall surface and related thru-wall flashings, flashings for rough openings, windows, doors, base flashings and terminations to the roof

2.02 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

- A. Air Barrier, Fluid Applied: Vapor permeable, elastomeric waterproofing.
 - 1. Air Barrier Coating:
 - a. Assembly Performance: Provide a continuous air barrier in the form of an assembly tested in accordance with ASTM E2357
 - b. Dry Film Thickness (DFT): Shall be minimum thickness as specified in the manufacturer written instructions for the substrate being applied and to produce a smooth pinhole-free surface and as required to achieve warranty.
 - c. Air Permeance: 0.004 cubic feet per minute per square foot, maximum, when tested in accordance with ASTM E2178.
 - d. Water Vapor Permeance: 10 perms, minimum, when tested in accordance with ASTM E96/E96M, Procedure B.
 - e. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to six months of weather exposure after application.
 - f. Tensile bond: Minimum 15 psi or exceeds strength of substrate when tested in accordance with ASTM C297/C297M.
 - g. Pull Adhesion: Minimum 110kPa (16psi) or substrate failure in accordance with ASTM D4541 for the substrate being applied.
 - h. Multi-Story Wall Assembly Burn Test: For multi-story buildings where required by code, Air Barrier, as a component of a wall assembly, shall have passed a NFPA 285 complete wall fire test.
 - i. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 - j. Nail Sealability: Pass, when tested in accordance with ASTM D1970/D1970M.
 - k. VOC Content: 50 g per L or less.
 - l. Code Acceptance: Comply with applicable requirements of ICC-ES AC212.
 - m. Sealants, Tapes and Accessories: As recommended by coating manufacturer.
 - n. Manufactures and Products:
 - 1) Acrylic, Water-Based:
 - (a) Barritech VP by Carlisle Coatings and Waterproofing, Inc: www.carlisleccw.com
 - (b) Air-Bloc 33MR, 17MR by Henry Company: www.henry.com
 - (c) R-Guard by PROSOCO, Inc: www.prosoco.com
 - (d) Wall Guardian by STS Coatings, Inc.: www.stscoatings.com

- (e) ExoAir 230 by Tremco Commercial Sealants & Waterproofing:
www.tremcosealants.com
- 2) STPE Based:
 - (a) Air-Bloc All Weather STPE, 33MR, 17MR by Henry Company:
www.henry.com
 - (b) Cat 5 by PROSOCO, Inc: www.prosoco.com
 - (c) DensDefy by Georgia-Pacific: www.buildgp.com
- 3) Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESSORIES

- A. Sealants, Flashings, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.
- B. Self-adhered Membrane Through Wall Flashing:
 - 1. Provide air barrier manufacturer's flexible, self-sealing through-wall flashing with silicone release sheet and associated accessories for:
 - a. Flashing at spandrels and cavities; under copings, band courses, and sill
 - b. Over lintels and shelf angles
 - c. At low roof to high wall conditions and all other wall conditions necessary to provide a watertight wall assembly.
 - 2. Manufacturers: Flashings shall be provided by the air barrier manufacturer, or explicitly approved in writing by the air barrier manufacturer for use as part of their warranted air barrier system.
 - 3. Accessories:
 - a. Provide manufacturer's surface conditioner and primer.
 - b. Termination Mastic:
 - 1) Description: Manufacturer's approved mastic with 200 g/l max. VOC Content.
 - c. Provide stainless steel type 304 termination bar equal to Hohmann & Barnard model T2-FTS with pre-punched holes at 8-inches on center max.
 - d. Provide three dimensional preformed external corners and end dams.
 - e. Refer to Section 07 6200 for metal through wall flashing drip edges and flashings.
- C. Liquid Flashing: One part, fast curing, non-sag, elastomeric, gun grade, trowelable liquid flashing.
- D. Transition Membrane, Seam and Window Flashing and High Temperature Rated Membrane: Peel and stick flashing membrane film bonded to sealant.
 - 1. Thickness: 25 mil, 0.025 inch minimum.
 - 2. Roll Width: 4, 6, 8 inch, as required for application.
 - 3. Coordinate installation with the Masonry Contractor and other provisions as required in Section 04 2000 - Unit Masonry.
- E. Thinners and Cleaners: As recommended by material manufacturer.
- F. Backer Rod: ASTM C 1330, Type B (bicellular material with a surface skin).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and conditions are ready to accept the work of this section.
- B. Walls
 - 1. Substrates
 - a. Wall sheathing must be securely fastened per applicable building code and sheathing manufacturer's requirements.

- b. Examine surfaces to receive air/water resistive barrier and verify that substrate and adjacent materials are dry, clean, sound, and free of releasing agents, paint, or other residue or coatings. Verify substrate is flat, free of fins or planar irregularities greater than 1/4" in 10'. Verify that no excess mortar exists on masonry ties, shelf angles and other obstructions.
- c. Verify that concrete is visibly dry and free of moisture.
- d. Verify that masonry joints are struck flush and completely filled with mortar.
- 2. Flashings
 - a. All flashings must be installed in accordance with specific design and building code requirements. Where appropriate, end-dams must be provided.
 - b. Openings must be flashed prior to window/door, HVAC, etc. installation. Windows and openings shall be flashed according to design and building code requirements.
 - c. Individual windows that are ganged to make multiple units require continuous head flashing and the joints between the units must be fully sealed.
- 3. Kick-out flashing
 - a. Kick-out flashing must be installed leak-proof and angled (min 100°) to allow for proper drainage and water diversion.
- 4. Air Seals
 - a. Install between the primary air/weather barrier and other wall components (penetrations, etc.) in order to maintain continuity of the air barrier system
- C. Report all unsatisfactory conditions to the General Contractor. Application of fluid-applied air/water-resistive barrier shall not proceed until all unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. General: No additives are permitted unless specified in product mixing instructions. Close containers when not in use. Prepare in a container that is clean and free of foreign substances. Do not use a container which has contained or been cleaned with a petroleum-based product. Clean tools and equipment with water immediately after use. Dried material can only be removed mechanically.
- B. Sheathing joints or joints in ICF less than 1/2" shall be treated with liquid flashing as recommended by the manufacturer.
- C. Sheathing joints or joints in ICF over 1/2" shall be treated with transition material or as recommended by the manufacturer.
- D. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
- E. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's instructions.

3.03 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
 - 1. Apply additional membrane and/or sealant at all masonry wall ties and zee subframing fastened through air barrier for claddings.
- C. Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.
- D. Coatings:
 - 1. Prepare substrate in manner recommended by coating manufacturer; treat joints in substrate and between dissimilar materials as recommended by manufacturer.

2. Where exterior masonry veneer is to be installed, install masonry anchors before installing weather barrier over masonry; seal around anchors air tight.
 3. Use flashing to seal to adjacent construction and to bridge joints.
- E. Membrane Through Wall Flashings at Masonry:
1. General:
 - a. Whether or not specifically indicated, install membrane flashings to divert water to exterior at all locations where downward flow of water will be interrupted.
 - b. Install metal through wall flashing in accordance with Section 07 6200. Metal flashing shall be continuous including at elevation changes (i.e. steps).
 2. Mockup:
 - a. Contractor shall provide an in-place mockup for review by Architect and Consultant of complete through wall flashing system, including stainless steel drip edges, incorporating end dams at a typical termination of flashing.
 - b. Failure to provide mockup or review of through wall flashing materials prior to installation of insulation and masonry may result in removal and reinstallation of materials at Contractor's expense, as required to observe installed conditions at flashings.
 - c. Through wall flashings that are improperly installed or installed in the wrong position, regardless of whether cladding has been installed or not, shall be removed by the Contractor and new flashings installed to the proper condition at no cost to the Owner.
 3. Preparation:
 - a. Install flashing to dry surfaces when air and surface temperatures are 40°F and above.
 - b. All flashings shall be installed to produce a fully watertight assembly.
 - c. Prepare the masonry surfaces so that they are smooth and free of obstructions where installing flashings. Apply the surface conditioner per the manufacturers written recommendations for proper adhesion of the flashings.
 - d. Precut pieces of flashing to easily handled lengths for each location.
 4. Installation:
 - a. Remove release paper and position flashing carefully before placing it against the surface.
 - b. When properly positioned, place against surface by pressing firmly into place by hand roller. Fully adhere flashing to substrate to prevent water from migrating under flashing.
 - c. Overlap adjacent pieces 6" and roll all seams with a steel hand roller.
 - d. Install prefabricated external and internal corners and end dams.
 - e. Extend the flashing from 1/2" inside the face of the exterior wall, through the exterior masonry wythe, and up the cavity space a minimum of 6" above the top of the cavity drainage system. Install termination bar at top of flashing and seal with mastic. Strip in air barrier over through wall flashing.
 - f. Apply a bead or trowel coat of mastic along flashing top edge, seams, cuts, and penetrations for a completely watertight condition.
 - g. Membrane flashing shall not be permanently exposed to sunlight.
 5. Transitions:
 - a. At all flashing terminations to openings, expansion joints, and changes in height, provide metal and membrane formed end dams with all seams sealed watertight.
 - b. Provide compressible filler at the end of all flashings at steel lintels.
 6. Protection:
 - a. Do not expose flashing membrane to sunlight for more than thirty (30) days prior to enclosure.
-

- b. Do not allow the surface of the flashing membrane to come in contact with incompatible materials, including but not limited to polysulfide sealants, creosote, uncured coal tar products or EPDM.
- F. Openings and Penetrations in Exterior Weather Barriers:
- 1. Install flashing extending a minimum 3 inches onto vertical wall and into rough opening with transition membrane.
 - 2. Hollow Metal Door Frames: Seal door frame to wall surface with transition membrane.
 - 3. Perimeter wood nailers at wall openings: Cover all exposed surfaces of wood nailers with transition membrane. Extend membrane over ICF, sheathing, masonry and metal framing.
 - 4. Aluminum frames: Seal frames to the wall surface with transition membrane.
 - 5. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.
 - 6. Cladding Attachment Penetrations: provide application of butyl tape to the base of all masonry ties and subgirts installed with fasteners through weather barrier.
- G. Expansion Joints in Exterior Weather Barriers:
- 1. Expansion joints are required at all structural expansion joints and along slip tracks in metal stud framing systems at walls. Provide manufacturer's recommended detailing at other locations with potential movement, including control joints in concrete masonry wall systems.
 - 2. Coordinate installation of new infill wall materials after removal of any existing cladding materials, to ensure that expansion joint at weather barrier plane is in line with expansion joint at exterior cladding.
 - 3. Install weather barrier materials at new infill wall, provide sealed termination bar secured at 6" o.c., extending a minimum of 4 inches onto the existing backup wall and weather barrier system. Ensure that all terminations of new weather barrier at existing is air- and water-tight.
 - 4. Install insulation and fire rated materials at gap as indicated in the Drawings or required for wall construction.
 - 5. Provide transition membrane and backer rod at gap as indicated in the Drawings, fully stripped in with fluid applied weather barrier system in full accordance with manufacturer details and requirements.
 - 6. Expansion joints at air barrier system shall be sealed air and watertight to expansion joint materials in roofing systems, with compatible materials.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Do not cover installed weather barriers until required inspections have been completed. Contractor is responsible for coordinating all inspections with Architect and/or Owner.
- C. Obtain approval of installation procedures by the weather barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.
- D. Take digital photographs of each portion of the installation prior to covering up.
- E. Weather Barrier Protection and Failure Protocol:
 - 1. Contractor failure to provide the protection specified will result in the following, at no cost to the Owner:
 - a. Replacement of all failed materials in full accordance with manufacturer requirements, to dry substrates. Failure is defined as inadequate adhesion, chemical deterioration, or blisters (entrapped air). After replacement the Contractor shall provide the above specified protection until completion of roofing materials.

3.05 PROTECTION

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 07 5216
SBS MODIFIED MEMBRANE ROOFING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. All labor, equipment, and materials to install the modified bitumen roof system over light weight insulating concrete over metal deck substrate.
- B. Walkway pads, sheet metal flashings, expansion joints, and other work incidental to the complete and proper installation of a watertight modified bitumen membrane roofing system whether shown or not on the drawings or as specified herein, and in accordance with all applicable manufacturer's requirements of the roofing system for issuance of the specified warranty.

1.02 RELATED WORK:

- A. Section 03 5216 - Lightweight Insulating Concrete
- B. Section 06 1000 - Rough Carpentry
- C. Section 07 6200 -Sheet Metal Flashing and Trim
- D. Section 07 7200 - Roof Accessories.
- E. Division 22 - Plumbing
- F. Division 23 - HVAC
- G. Division 26 - Electrical

1.03 SUBMITTALS

- A. Review and comply with all provisions of section 01 3300-Submittals.
 - 1. Failure to follow required provisions may result in submittal being rejected without review.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
 - 1. Product data shall include test certificates / reports, other certifications and applicable documentation to demonstrate compliance and as required by the specification.
- C. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
- D. Installation details submitted for review shall be specific to the work of this contract and accurately depict interface with adjacent assemblies / materials depicted in the assembly(s) indicated on the Drawings.
 - 1. Generic details that do not depict actual conditions shall not be acceptable.
 - 2. Where blocking is required, clearly indicate type, size and location; and coordinate with other trades as required for proper installation
- E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 1. Include recommended cleaning products and instructions for use.
 - 2. Where applicable, provide recommended maintenance schedules and procedures.
- F. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 1. Show profiles, sizes, spacing and locations of assembly components. 02 Show details of shop fabrications, connections and details.
 - 2. Show details of field fabrications, connections and details.
 - 3. Provide calculations demonstrating compliance with wind load and other design/ code requirements.

4. Shop drawings shall be sealed and signed by a Texas registered engineer.
- G. Certifications:
 1. Provide letter from manufacturer, signed by an officer, stating the installer is licensed and / or certified by the manufacturer to provide the installation.
 2. Certification of Class A roof system.
 3. Submit certification that the roof system furnished is Tested and Approved by Factory Mutual Standard No. 4470 as a Class 1 roof assembly with 1-90 Wind Uplift Requirements.
 4. Certified copy of ISO 9002 compliance.
- H. Design Loads: Submit copy of manufacturer's minimum design load calculations according to ASCE 7-05, Method 2 for Components and Cladding, sealed by a registered professional engineer employed by the system manufacturer as a full-time staff engineer. 01 In no case shall the design loads be taken to be less than those required by applicable codes and authorities having jurisdiction.
- I. Operations and Maintenance Manuals
 1. Provide complete operations and maintenance manuals to the Owner.
 2. Refer to section 01 78 23 — Operations and Maintenance Manuals.
 3. O & M manuals must be reviewed, accepted and delivered to the Owner prior to Owner demonstration(s).
- J. Warranty:
 1. Provide one (1) sample of each warranty proposed to be furnished.

1.04 REFERENCES

- A. American Society of Testing and Materials (ASTM):
 1. ASTM C920 - Standard Specifications for Elastomeric Joint Sealants.
 2. ASTM D41 - Specification for Asphalt Primer Used in Roofing, Damproofing, and Waterproofing
 3. ASTM D312 - Specification for Asphalt Used in Roofing
 4. ASTM D451 - Test Method for Sieve Analysis of Granular Mineral Surfacing for Asphalt Roofing Products
 5. ASTM D1079 - Terminology Relating to Roofing, Waterproofing, and Bituminous Materials.
 6. ASTM D1227 - Specification for Emulsified Asphalt Used as a Protective Coating for Roofing
 7. ASTM D1863 - Specification for Mineral Aggregate Used on Built-Up Roofs
 8. ASTM D2178 - Specification for Asphalt Glass Felt Used in Roofing and Waterproofing
 9. ASTM D2822 - Specification for Asphalt Roof Cement
 10. ASTM D2824 - Specification for Aluminum-Pigmented Asphalt Roof Coating
 11. ASTM D3019 - Specification for Lap Cement Used with Asphalt Roll Roofing
 12. ASTM D4479 - Standard Specification for Asphalt Roof Coatings— Asbestos- Free
 13. ASTM D4586 - Standard Specification for Asphalt Roof Cement, Asbestos- Free
 14. ASTM D4601 - Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing
 15. ASTM D4897 - Standard Specification for Asphalt-Coated Glass-Fiber Venting Base Sheet Used in Roofing
 16. ASTM D5147 - Test Method for Sampling and Testing Modified Bituminous Sheet Materials
 17. ASTM D5849 - Standard Test Method for Evaluating Resistance of Modified Bituminous Roofing Membrane to Cyclic Fatigue (Joint Displacement)“
 18. ASTM E108 - Test Methods for Fire Test of Roof Coverings
- B. FM: Factory Mutual

- C. NRCA: National Roofing Contractors Association: Roofing and Waterproofing Manual
- D. Underwriters' Laboratories (UL): Fire Hazard Classifications.
- E. Sheet Metal and Air Conditioning Contractors National Association Inc. (SMACNA): Architectural Sheet Metal Manual.

1.05 MANUFACTURER / INSTALLER QUALIFICATIONS

- A. Manufacturer Qualifications: Roofing system manufacturer shall have a minimum of 10 years' experience in manufacturing modified bitumen roofing products in the United States and shall be ISO 9002 certified.
- B. Installer Qualifications:
 - 1. Shall be specializing in modified bituminous roof application with minimum 5 years' experience.
 - 2. Shall be certified by the roofing system manufacturer as qualified to install manufacturer's roofing system.
 - 3. Shall be among manufacturer's top-tier installers.
- C. No subcontracting of sheet metal fabrication or installation will be accepted. Contractor must have a sheet metal shop on the company premises.
- D. It is the intent of this specification to provide a roof system with an external fire rating.
 - 1. The descriptions given below are general descriptions.
 - 2. All components shall be as required by the membrane manufacturer to provide a Class One F.M. No. 4470 assembly.
- E. Installer's Field Supervision:
 - 1. Installer to provide a full-time Supervisor / Foreman on the job site during all phases of modified bituminous sheet roofing work.
 - 2. Direct supervision of workmen shall be maintained at all times when roofing work is in progress.
 - 3. The project specifications and final submittals shall be accessible on the roof and used by the Supervisor / Foremen at all times when roofing work is in progress.
- F. The Contractor's shall closely monitor roofing work cause deficiencies to be immediately corrected during construction.
- G. The Contractor shall coordinate all trades as required for proper installation of work interfacing with roofing work.
- H. Pre-construction Roofing Conference: Prior to installation of metal roofing deck, conduct a meeting at the site with roofing installer, installer of each component of associated work, installers of deck or substrate construction to receive roofing work, installers of rooftop units and other work in the around roofing that must precede or follow roofing work (including MEP work), Architect, roofing system manufacturer's representative, District's Project Manager, District's material testing lab, and other representatives directly concerned with performance of the Work, including (where applicable) Owner's insurers, test agencies, and governing authorities. Objectives to include:
 - 1. Review foreseeable methods and procedures related to roofing work. Tour representative areas of roofing substrates (decks), inspect and discuss condition of substrate, roof drains, curbs, penetrations, and other preparatory work performed by other trades.
 - 2. Review structural loading limitations of deck and inspect deck for loss of flatness and for required attachment.
 - 3. Review roofing systems requirements (drawings, specifications, and other contract documents).
 - 4. Review required submittals, both completed and yet to be completed.

5. Review and finalize construction schedule related to roofing work and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
6. Review required inspection, testing, certifying, and material usage accounting procedures.
7. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary roofing (if not a mandatory requirement).
8. Record (contractor) discussion of conference, including decisions and agreements (or disagreements) reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.
9. Review notification procedures for weather or non-working days.

1.06 QUALITY ASSURANCES

- A. Work and materials hereinafter specified shall be best of kind described and, unless specified otherwise, shall be new and of best quality.
 1. All roofing materials utilized in performance of each type of work shall be the products of one manufacturer of supplier.
- B. Materials will be securely fastened in place in a watertight, neat and workmanlike manner.
 1. All workmen shall be thoroughly experienced in the particular class of work upon which employed.
 2. Work shall be performed in accordance with these specifications and shall meet the approval in the field of the Architect.
- C. Contractor shall plan and conduct the operations of the work so that each section started on one day is complete, details installed and thoroughly protected before the close or work for that day.
- D. Unless otherwise indicated, the materials to be used in this specification are those specified and denote the type, quality, performance, etc. required.
 1. All proposals shall be based upon the use of the specified material.
- E. Application of materials shall be in accordance with the manufacturer's standards and recommendations.
 1. In the instance of a conflict between these specifications and those of the manufacturer, the most stringent shall take precedence.
- F. In compliance with IBC—2018, the roofing system manufacturer shall meet ASCE 7—current edition wind uplift requirements and shall meet Underwriter's Laboratory Class "A" Fire Rating.
- G. The roof system shall pass 500 cycles of ASTM D5849 Resistance to Cyclic Joint Displacement (fatigue) at 14° F (-10° C).
 1. Passing results shall show no signs of membrane cracking or interplay delamination after 500 cycles.
 2. Manufacturer to provide written compliance with this test to be acceptable.
- H. Certificate of Analysis: provide manufacturers printed Certificate of Analysis for all materials used and attach with Final Warranty.
- I. Fire watch inside the building is required for all torch applied roofing.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in manufacturer's original unopened packaging with all tags and labels intact and legible.
 1. Carton and can labels shall indicate appropriate warning, storage conditions, lot numbers, and usage instructions.
 2. Handle and store materials and equipment in such a manner as to avoid damage.

- B. Store all materials in a dry location protected from damage and dirt, not on roof. Store all materials in an on-site storage container or other Siplast approved method. The Architect and Owner's on-site roof inspector must do monitoring of stored material. All violations to be reported to CFISD's Project Manager.
- C. Products liable to degrade as a result of being frozen shall be maintained above 40° F in heated storage.
- D. The proper storage of materials is the sole responsibility of the contractor.
 - 1. Materials damaged in shipping or storage shall not be used.
 - 2. Wet or damaged roofing materials shall be discarded, removed from job site, and replaced with new materials prior to application.
- E. No storage of materials shall be permitted on roof areas other than those materials that are to be installed the same day. In no case shall material be stored on the existing roof. Any exception must be in written form.
 - 1. Do not place materials or equipment in such a manner as to overload structure.
 - 2. Handle and store materials or equipment in a manner to avoid significant or permanent deflection of deck.

1.08 FIELD REPRESENTATION

- A. Manufacturer's Field Representative: An authorized, technical agent of the roofing manufacturer shall be assigned to the project to conduct field observations during the installation phase.
 - 1. In as much as possible, the originally assigned field representative shall remain consistent for all site visits and observations.
- B. Regularly scheduled, on site observations shall be required by the manufacturer's field representative a maximum of every fourth working day during the roofing installation period; exceptions being made for inclement weather, holidays, etc.
 - 1. Manufacturer's representative shall notify the Contractor and Architect's field representative of scheduled site visits a minimum of 24 hours in advance.
- C. Observation reports shall include the following:
 - 1. Written report / documentation of the installation progress at the time of the site visit.
 - 2. The report shall include documentation of any issues / questions and how the issue(s) were resolved.
 - 3. The report shall include record of directives given to the roofing contractor
 - 4. Digital photographic documentation of the roofing progress; including documentation of specific issues and areas / details in question.
 - 5. Each report shall contain project name, Bay-IBI project number, date / time / duration of site visit,
- D. In addition to the progress observations, the manufacturer's representative must:
 - 1. Attend the roofing trade start-up meeting;
 - 2. Approve the application of the base ply membranes,
 - 3. Approve the application of granulated cap sheet membranes,
 - 4. Approve the application of completed roofing system.
- E. All observation reports shall be kept current and shall be delivered electronically to the Contractor and Architect within five (5) calendar days after the observation. Progress payments for roofing work may be withheld if observation report submissions are not current.
- F. After completion of all roofing work, and prior to acceptance of the roofing installation, manufacturer's representative shall conduct an observation to document all roofing work to be corrected as a condition of acceptance.
 - 1. Each item requiring corrective work shall be identified (including specific location) and required corrective action shall be noted.

2. The final observation report must be produced in writing with photographic back-up. Marking corrective items on the roof alone shall not be acceptable.

1.09 ADDITIONAL REPRESENTATION AND INSPECTION REQUIREMENTS

- A. Full-time observation by Owner's Roofing Consultant is required for all new roofs and reroofing work. Contractor / General Contractor to submit an inspection schedule to the Owners Roofing Consultant weekly with a minimum of 48-hours notification to the Owners Roofing Consultant for inspections.
- B. Installation of Paradiene 20 modified bitumen base ply membrane sheet, Paradiene 30 FR BW granulated modified bitumen cap sheet membrane, roof flashing material (i.e. Veral aluminum clad modified bitumen flashing membrane), must be monitored 100% full time by Owner's Roofing Consultant. Roof Consultant shall report directly to Owner Project Manager and Architect.
- C. Installation of entire roofing system shall be monitored by the Owner's Roofing Consultant. Owner's Roofing Consultant shall report to the CFISD Project Manager on progress and provide daily reports to the Contractor. Owner's Roofing Consultant does not have the responsibility of providing corrective direction to the Contractor.
- D. The Architect, Owner Project Manager and Manufacturer Representative shall review each phase of the roofing installation. Architect shall schedule / coordinate visits by the Manufacturer Representative.

1.10 PROJECT CONDITIONS

- A. Weather Condition Limitations: Do not apply roofing membrane during inclement weather or when a 40% chance of precipitation is expected.
- B. Do not apply roofing insulation or membrane to damp deck surface.
- C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.
- D. Proceed with roofing work only when existing and forecasted weather conditions will permit unit of work to be installed in accordance with manufacturer's recommendations and warranty requirements.

1.11 SEQUENCING AND SCHEDULING

- A. Sequence installation of modified bituminous sheet roofing with related units of work specified in other sections to ensure that roof assemblies, including roof accessories, flashing, trim, and joint sealers, are protected against damage
 1. from effects of weather, corrosion, and adjacent construction activity.
- B. All work must be fully completed on each day. Phased construction will not be accepted. Roof must be thoroughly protected before the close of work for that day.

1.12 DESIGN AND PERFORMANCE CRITERIA

- A. Uniform Wind Uplift Load Capacity:
 1. All roofing and roofing assemblies shall be installed as required to meet the specified wind loads, IBC-2018 requirements and all applicable codes and ordinances of local authorities having jurisdiction.
- B. The manufacturer and roofing contractor shall verify all requirements prior to submission of bid.

1.13 WARRANTY

- A. Modified Bitumen Roofing — Manufacturer: Project shall be installed in such a manner that the roofing material manufacturer will furnish a written 20 year full system warranty for the completed roofing assembly.
 1. Warranty will be a "no dollar limit/no penal sum" labor and material warranty, with total replacement cost.

2. No exclusion for ponded water.
 3. Manufacturer will warranty all components of the roof system, including new lightweight insulating concrete decks, all new insulation, if any, and all flashings and sheet metal in writing.
- B. Roofing Contractor: The contractor, jointly with any subcontractors employed by him, shall guarantee the work required and performed under this contract will be free from defects in workmanship and materials, and that the building will be and remain waterproof for a five (5) year warranty period, after the Architect accepts the work as substantially complete.
1. The warranty shall be in approved notarized written form, to obligate the Contractor, and subcontractors, to make good the requirements of the warranty.
 2. The warranty shall be held jointly with the Bonding Company for the first two (2) years and the manufacturer for the remaining three (3) years.
- C. Sheet Metal: Contractor shall provide a five (5) year written warranty for all sheet metal.
- D. Warranty shall cover defects in materials and workmanship for the warranty period.
1. Contractor shall provide a manufacturer's 20 year material warranty.
- E. Membrane manufacturer will provide an annual inspection for the life of the warranty.
1. Upon completion of annual inspection, provide a written summary to the Owner, including overall status of roofing and potential deficiencies.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. The design and specification for the Modified Bitumen Membrane Roofing system is based on roofing systems manufactured by Siplast.

2.02 GENERAL

- A. All materials shall be manufactured, specified, or accepted in writing by membrane manufacturer issuing the warranty.
1. Proposed materials shall ensure full system warranty from said manufacturer.
 2. Installer shall be an applicator licensed by the manufacturer.
- B. Samples of all materials used on the project, which are not supplied by the membrane manufacturer, shall be submitted to the membrane manufacturer for written approval prior to starting work.
- C. All materials used on the project shall be asbestos-free.

2.03 BITUMINOUS MATERIALS

- A. Asphalt Primer: V.O.C. compliant, ASTM D41.
- B. Asphalt Roofing Mastic: V.O.C. compliant, ASTM D2822, Type II.
- C. Elastomer: V.O.C. compliant, Trowel able asphalt elastomeric mastic.

2.04 ROOF MEMBRANE MATERIAL

- A. Roofing Membrane Assembly: A roof membrane assembly consisting of two plies of a prefabricated, reinforced, homogeneous Styrene-Butadiene-Styrene (SBS) block copolymer modified asphalt membrane, applied over a prepared substrate. Reinforcement mats shall be impregnated/saturated and coated each side with SBS modified bitumen blend and coated one side with a torch grade SBS bitumen blend adhesive layer. The adhesive layer shall be manufactured using a process that embosses the surface with a grooved pattern to provide optimum burn-off of the plastic film and to maximize application rates. The cross-sectional area of the sheet material shall contain no oxidized or non-SBS modified bitumen. The roof system shall pass 500 cycles of ASTM D5849 Resistance to Cyclic Joint Displacement (fatigue) at 14°F (-10°C). Passing results shall show no signs of membrane cracking or interply delamination after 500 cycles. The roof system shall pass 200 cycles of ASTM D5849 after heat conditioning performed in accordance with ASTM D 5147. The assembly shall possess waterproofing capability, such that a phased roof application, with only the modified bitumen base ply in place, can be achieved for prolonged periods of time without detriment to the watertight integrity of the entire roof system.
1. Approved product:
 - a. Siplast Paradiene 20 TG/30 FR TG BW -Torch Applied Roof System
 2. Modified Bitumen Base and Stripping Ply:
 - a. Thickness (avg): 114 mils (2.9 mm) (ASTM D 5147)
 - b. Thickness (min): 110 mils (2.8 mm) (ASTM D 5147)
 - c. Weight (min per 100 ft' of coverage): 76 lb (3.7 kg/m')
 - d. Maximum filler content in elastomeric blend: 35% by weight
 - e. Low temperature flexibility @ - 15°F (-26°C): PASS (ASTM D 5147)
 - f. Peak Load (avg) @ 73°F (23°C): 30 lbf/inch (5.3 kN/m) (ASTM D 5147)
 - g. Peak Load (avg) @ 0°F (-18°C): 75 lbf/inch (13.2 kN/m) (ASTM D 5147)
 - h. Ultimate Elongation (avg.) @ 73°F (23°C): 50% (ASTM D 5147)
 - i. Dimensional Stability (max): 0.1% (ASTM D 5147)
 - j. Compound Stability (min): 250°F (121°C) (ASTM D 5147)
 - k. Approvals: UL Class listed, FM Approved (products shall bear seals of approval)
 - l. Reinforcement: fiberglass mat or other meeting the performance and dimensional stability criteria
 - m. Approved product: Siplast Paradiene 20 – Torch Grade
 3. Modified Bitumen Finish Ply:
 - a. Thickness (avg): 138 mils (3.5 mm) (ASTM D 5147)
 - b. Thickness at selvage (coating thickness) (avg): 118 mils (3.0 mm) (ASTM D 5147)
 - c. Thickness at selvage (coating thickness) (min): 114 mils (2.9 mm) (ASTM D 5147)
 - d. Weight (min per 100 ft' of coverage): 112 lb (5.4 kg/m')
 - e. Maximum filler content in elastomeric blend: 35% by weight
 - f. Low temperature flexibility @ - 15°F (-26°C): PASS (ASTM D 5147)
 - g. Peak Load (avg) @ 73°F (23°C): 30 lbf/inch (5.3 kN/m) (ASTM D 5147)
 - h. Peak Load (avg) @ 0°F (-18°C): 75 lbf/inch (13.2 kN/m) (ASTM D 5147)
 - i. Ultimate Elongation (avg.) @ 73°F (23°C): 55% (ASTM D 5147)
 - j. Dimensional Stability (max): 0.1% (ASTM D 5147)
 - k. Compound Stability (min): 250°F (121° C) (ASTM D 5147)
 - l. Granule Embedment (max loss): 2.0 grams per sample (ASTM D 5147)
 - m. Approvals: UL Class listed, FM Approved (products shall bear seals of approval)
 - n. Reinforcement: fiberglass mat or other meeting the performance and dimensional stability criteria
 - o. Surfacing: ceramic granules
 - p. Approved Product: Siplast Paradiene 30 FR TG BW — Torch Grade

2.05 FLASHING MEMBRANE ASSEMBLY

- A. Flashing Membrane Assembly: A flashing membrane assembly consisting of a prefabricated, reinforced, Styrene-Butadiene-Styrene (SBS) block copolymer modified asphalt membrane with a continuous, channel-embossed metal-foil surfacing. The finish ply shall conform to ASTM D 6298 and the following physical and mechanical property requirements.
1. Approved Product:
 - a. Siplast Veral flashing system, aluminum finish.
 2. Cant Backing Sheet and Flashing Reinforcing Ply
 - a. Thickness (avg): 102 mils (2.6 mm) (ASTM D 5147)
 - b. Thickness (min): 98 mils (2.5 mm) (ASTM D 5147)
 - c. Weight (min per 100 ft² of coverage): 72 lb (3.5 kg/m²)
 - d. Maximum filler content in elastomeric blend: 35% by weight
 - e. Low temperature flexibility @ -15° F (-26° C) - PASS (ASTM D 5147)
 - f. Peak Load (avg) @ 73°F (23°C): 30 lbf/inch (5.3 kN/m) (ASTM D 5147)
 - g. Peak Load (avg) @ 0°F (-18°C): 75 lbf/inch (13.2 kN/m) (ASTM D 5147)
 - h. Ultimate Elongation (avg.) @ 73°F (23°C): 50% (ASTM D 5147)
 - i. Dimensional Stability (max): 0.1% (ASTM D 5147)
 - j. Compound Stability (min - sheet): 250°F (121°C) (ASTM D 5147)
 - k. Compound Stability (min — adhesive coating): 212°F (100°C) (ASTM D 5147)
 - l. Approvals: UL Class listed, FM Approved (products shall bear seals of approval)
 - m. Reinforcement: fiberglass mat or other meeting the performance and dimensional stability criteria
 - n. Back Surfacing: polyolefin film
 - o. Approved Product: Siplast Paradiene 20 SA
 3. Metal-Clad Modified Bitumen Flashing Sheet
 - a. Thickness (avg): 142 mils (3.6 mm) (ASTM D 5147)
 - b. Thickness (min): 138 mils (3.5 mm) (ASTM D 5147)
 - c. Weight (min per 100 ft² of coverage): 92 lb (4.5 kg/m²)
 - d. Coating Thickness — back surface (min): 40 mils (1 mm) (ASTM D 5147)
 - e. Low temperature flexibility @ 0° F (-18° C): PASS (ASTM D 5147)
 - f. Peak Load (avg) @ 73°F (23°C): 85 lbf/inch (15 kN/m) (ASTM D 5147)
 - g. Peak Load (avg) @ 0°F (-18°C): 180 lbf/inch (31.7 kN/m) (ASTM D 5147)
 - h. Ultimate Elongation (avg) @ 73°F (23°C): 45% (ASTM D 5147)
 - i. Tear-Strength (avg): 120 lbf(0.54 kN) (ASTM D 5147)
 - j. Dimensional Stability (max): 0.2% (ASTM D 5147)
 - k. Compound Stability (min): 225°F (107°C) (ASTM D 5147)
 - l. Cyclic Thermal Shock Stability (maximum): 0.2% (ASTM D 7051)
 - m. Approvals: UL Approved, FM Approved (products shall bear seals of approval)
 - n. Reinforcement: fiberglass scrim mat or other meeting the performance and dimensional stability criteria
 - o. Surfacing: aluminum metal foil
 - p. Approved Product: Siplast Veral Aluminum Clad Modified Bitumen Flashing Membrane.
- B. Catalyzed Acrylic Resin Flashing System: A specialty flashing system consisting of a liquid-applied, fully reinforced, multi-component acrylic membrane installed over a prepared or primed substrate. The flashing system consists of a catalyzed acrylic resin primer, basecoat and topcoat, combined with a non-woven polyester fleece. The resin and catalyst are pre-mixed immediately prior to installation. The use of the specialty flashing system shall be specifically approved in advance by the membrane manufacturer for each application.
1. Approved Product: Parapro 123 Flashing System by Siplast; Irving, TX

2.06 ROOFING SHEET METAL

- A. Refer to Section 07 62 00 — Sheet Metal Flashing.

2.07 RELATED MATERIALS

- A. Bituminous Cutback Materials:
1. Primer: A high flash, quick drying, asphalt solvent blend which meets or exceeds ASTM D41 requirements.
 - a. Approved product: PA-1125 Asphalt Primer.
 2. Mastics: asphalt cutback mastic, reinforced with non-asbestos fibers, used as a base for setting metal flanges and conforming to ASTM D4586 Type II requirements.
 - a. Approved product: PA-1021 Plastic Cement.
 3. Primer for Self-Adhesive Sheets: A quick drying, low-VOC, water-based, high-tack primer specifically designed to promote adhesion of roofing and waterproofing sheets to approved substrates. Primer shall meet South Coast Air Quality District and Ozone Transport Commission requirements.
 - a. Approved product: TA-119 Primer by Siplast; Irving, TX
- B. Caulking and Sealants: A single component, high performance, elastomeric sealant. Acceptable types are as follows:
1. PS — 304 Elastomeric Sealant — meets or exceeds performance of Federal spec TT-S-00230C Type II Class A.
- C. Ceramic Granules: No. 11 BW Grade Specification Ceramic granules Color: Bright White
- D. Fiber Cant and Tapered Edge Strips: Performed rigid insulation units of sizes/shapes indicated, matching insulation board or of perlite or organic fiberboard, as per the approved manufacturer.
- E. Fasteners:
1. Shall be approved and as recommended by the manufacturer for the specified application.
 2. Fastener for Brick: Shall be 'Z' x 2", stainless steel nail, one piece unit, flat head as manufactured by Rawl Zamac Nailin, or approved equal.
 3. Fastener for Wood: Shall be a #14 fastener, fluorocarbon coated, with CR-10 coating. A minimum 0.200 inch diameter shank and 0.250 inch diameter thread. To be used with approved, round pressure plates or bar, and having a fluorocarbon CR-10 coating, when subjected to 30 Kesternich cycles (DIN 50018) shows less than ten percent (10%) red rust as manufactured by Olympic Manufacturing Group, Inc., or pre-approved equal.
 4. Base sheet Over Lightweight Concrete Deck: Shall be a split shank, one fastener to be used with a 2 'Z' bilateral perforated metal plate, both G-90 galvanized for non-corrosiveness as manufactured by Siplast, or approved equal.
 5. Nails: Stainless steel, ring shank, size as required to suite application minimum 11 gauge with 3/8 inch diameter head.
 6. Insulation Fasteners: Insulation fasteners and plates shall be FM Approved, and/or approved by the manufacturer of the primary roofing products. The insulation fasteners shall provide attachment required to meet the specified uplift performance and to restrain the insulation panels against the potential for ridding. The fastening pattern for each insulation panel to be used shall be as recommended by the insulation manufacturer and approved by the manufacturer of the primary roofing products. Acceptable insulation fastener manufacturers for specific deck types are listed below.
 - a. Metal Decks: Insulation mechanical fasteners for metal decks shall be factory coated for corrosion resistance. The fastener shall conform meet or exceed Factory Mutual Standard 4470 and when subjected to 30 Kesternich cycles, show less than 15% red rust. Acceptable insulation fastener types for metal decks are listed below.

- 1) A fluorocarbon coated screw type roofing fastener having a minimum 0.220 inch thread diameter. Plates used in conjunction with the fastener shall be a metal type having a minimum 3 inch diameter, as supplied by the fastener manufacturer.
 - 2) Approved Product: Parafast Fastener by Siplast; Irving, TX
- F. Walkway Pads: A prefabricated, puncture resistant polyester core reinforced, polymer modified bitumen sheet material topped with a ceramic—coated granule wearing surface meeting the following physical and mechanical requirements:
1. Thickness: 0.217 inch — (5.5 mm).
 2. Weight: 1.8 lb. /ft' —(8.8 kg/m').
 3. Width: 30 inches — (76.2 cm).
 4. Approved Product: "Paratread" Roof Protection Material.

2.08 MISCELLANEOUS MATERIALS AND ACCESSORIES

- A. Other materials shall be as shown, specified or required and be of the best grade for the proposed use as recommended by the manufacturer.
- B. Sealant Backer Rod: Provide compressible rod stock of polyethylene foam, polyurethane foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable, non-absorptive material as recommended by sealant manufacturer for back-up of and compatibility with sealant. Where used with hot-applied sealant, provide heat-resistant type which will not be deteriorated by sealant application temperature as indicated.
- C. Sealants: A moisture-curing, non-slump elastomeric sealant designed for roofing applications. The sealant shall be approved by the roof membrane manufacturer for use in conjunction with the roof membrane materials.
1. Acceptable type: Siplast PS-209 Elastomeric Sealant by Siplast; Irving, TX
- D. Butyl Sealer: Where impractical to use solder at joints, corners, etc., seal with "DAP Butyl Gutter and Lab Sealer" or "Cushion-Lock CL-50 Butyl Sealer".
- E. Nails, Rivets and Fastenings: Nails shall be stainless steel ring shank. Rivets shall be stainless steel, 300 Series. Aluminum — flat heat, sized as required.
- F. Pipe Hangers and Supports: Provide and install all necessary supports for gas lines, conduit, chilled water lines, duct work, condensate lines, etc. as manufactured by PHP Systems with NO SUBSTITUTIONS ALLOWED.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrate surfaces to receive modified bitumen sheet roofing system and associated work and conditions under which roofing will be installed.
1. Do not proceed with roofing until unsatisfactory conditions have been corrected in a manner acceptable to Installer.
- B. Lightweight Insulation Concrete Deck System: Nailable fills shall receive base sheet properly fastened and installed in accordance with local IBC Building Codes and local authorities having jurisdiction.
- C. A water test is to occur before the membrane installation occurs to identify and correct ponding or bird bath conditions.
- D. Sweep or vacuum all surfaces, removing all loose aggregate and foreign substances prior to commencement of roofing. Ensure dry, smooth surface with no depressions or ponding water.

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Cooperate with manufacturer, inspection and test agencies engaged or required to perform services in connection with installing modified bitumen sheet system.

- B. Aesthetic Considerations: An aesthetically pleasing overall appearance of the finished roof application is a standard requirement for this project. Make necessary preparations, utilize recommended application techniques, apply the specified materials (i.e.: granules, metallic powder, etc.) and exercise care in ensuring that the finished application is acceptable to the Owner.
- C. Protect other work from spillage of modified bitumen roofing materials, and prevent liquid materials from entering or clogging drains and conductors.
 - 1. Replace or restore other work damaged by installations of modified bituminous sheet roofing system work.
- D. Coordinate installing roofing system components so that insulation and roofing plies are not exposed to precipitation or left exposed overnight.
 - 1. Provide cut-offs at end of each day's work to cover exposed ply sheets and insulation with two courses of #15 organic felt with joints and edges sealed with roofing cement.
 - 2. Remove cut-offs immediately before resuming work.
- E. Substrate Joint Penetrations: Prevent bitumen from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.
- F. Apply roofing materials as specified herein unless recommended otherwise by manufacturer's instructions.
 - 1. Keep roofing materials dry before and during application. Do not permit phased construction.
 - 2. Do not permit phased construction.
 - 3. Complete application of roofing plies, modified sheet and flashing in a continuous operation.
 - 4. Begin and apply only as much roofing in one day as can be completed that same day.

3.03 BASE SHEET INSTALLATION

- A. Once all debris is removed from the roof substrate, and the deck is found to be in good condition, the contractor shall roll out the vented fiberglass base sheet, channel side down, over the surface.
 - 1. Lap subsequent sheets 4" over the preceding one and ends 6 inches.
 - 2. Extend sheet over and down wood blocking or existing fascia and tack in place.
 - 3. Fasteners and fastening patterns shall be determined by building height, pull out values from lightweight insulating concrete decks in accordance with all codes and requirements.
- B. Fastening patterns shall comply with manufacturer's requirements to meet the specified and required wind loads, for all areas of the roof plane:
 - 1. Zone 1 - Field Of Roof
 - 2. Zone 2 - Roof Perimeter
 - 3. Zone 3 — Corners.
- C. Extend sheet over wood blocking and down face; base sheet must extend continuously and evenly throughout the roof plane to provide a tight seal against the penetration of moisture vapor from below.

3.04 ROOF MEMBRANE INSTALLATION

- A. Membrane Application: Install roofing in accordance with roofing system manufacturer's current published instructions and the following requirements. Application of roofing membrane components shall immediately follow application of base sheet as a continuous operation.
- B. Priming: Prime metal flanges (all jacks, edge metal, lead drain flashings, etc.) and concrete and masonry surfaces with a uniform coating of ASTM D41 asphalt primer.
- C. Roofing Ply Application:
 - 1. Apply all layers of roofing free of wrinkles, creases or fish mouths.

2. Exert sufficient pressure on the roll during application to ensure prevention of air pockets.
 3. Lap seams between the base ply layer and the finish ply layer shall not coincide.
 4. Stagger the courses to ensure this.
 5. Apply all layers of roofing perpendicular to the slope of the deck.
 6. Fully bond the base ply to the mechanically attached base sheet with hot asphalt. Each sheet shall have minimum three (3) inch side laps and six (6) inch end laps. Each sheet shall be applied directly behind the asphalt applicator. Staggered end laps a minimum of three (3) feet.
 7. Fully bond the finish ply to the base ply with by torch application. Each sheet shall have a minimum of three (3) inch side and six (6) inch end laps. Stagger end laps of the finish ply a minimum of three (3) feet. Stagger side laps of the finish ply a minimum of three (3) feet from end laps in the underlying base ply.
 8. Exert sufficient pressure on the metal clad modified bitumen sheet to ensure the prevention of air pockets. This can be accomplished by using a damp, kitchen type sponge mop or a damp, heavy duty cotton nap paint roller.
 9. Prime all end laps of the metal clad modified bitumen sheet with a uniform coating of the specified asphalt primer and allow to thoroughly prior to overlapping of adjoining sheets.
 10. Probe laps using a clean, heated roofing trowel and heat fuse dry laps of the metal clad modified bitumen sheet to ensure a complete seal.
 11. Using clean, heated roofing trowel, lightly crimp the foil surfacing over the membrane edges (approximately 1/8-1/4 inch width along the side and end laps of the metal clad modified bitumen sheet).
 12. Maximum sheet lengths and special fastening of the specified roof membrane system may be required at various slope increments where the roof deck slope exceeds 1/4 inch per foot. The manufacturer shall provide acceptable sheet lengths and the required fastening schedule for all roofing sheet applications to applicable roof slopes. Cold process adhesives shall be used on slopes over 1/2 inch per foot up to and including six (6) inches per foot.
- D. Granule Embedment: Broadcast ceramic granules over all bitumen bleed outs on the finish ply surface, while the bitumen is still hot, to ensure a monolithic color.

3.05 FLASHING INSTALLATION

- A. General:
1. Flashings shall be installed using the manufacturer's Veral flashing membrane, with length of run not to exceed manufacturer's recommendations.
 2. Wooden nailers or curbs shall be installed at all edges and openings in the roof, mechanically fastened to the deck. The nailers should be of exterior grade pressure treated timber, and of the same thickness as any insulation to be used on the roof.
 3. Cant strips shall be installed at the intersection of the deck and/or all vertical surfaces. Prime all cants.
 4. The roofing field membrane shall extend up over and to the top of cant strips at all vertical intersections or out the roofs edge.
 5. All substrates receiving flashing membrane shall be clean and primed with asphalt primer, prior to application.
 6. All flashings and flashing cleats shall be mechanically fastened a maximum of 6" O.C., shall be a minimum of 8" above adjacent roof height, shall extend a minimum of 9" onto the field of horizontal roof membrane, and shall not exceed 10 LF in length.
 7. Provide termination bars at the top of vertical flashings, fastened a maximum of 6" O.C.
 8. Install flashing membrane in accordance with drawings and/or material manufacturer's guarantee requirements, whichever is the most stri
- B. Flashing Application — Masonry Surfaces:

1. Flash masonry parapet walls and curbs using the reinforcing sheet and the metal foil flashing membrane.
2. After the base ply has been applied to the top of the cant, fully adhere the reinforcing sheet, utilizing minimum 3" side laps and extend a minimum of 3" onto the base ply surface and 3" up the parapet wall above the cant.
3. After the final roofing ply has been applied to the top of the cant, prepare the surface area that is to receive flashing coverage by torch heating granular surfaces or by application of asphalt primer; allowing primer to dry thoroughly.
4. Torch apply the metal foil-faced flashing into place using 36" widths (cut off the end of roll) always lapping the factory selvage edge.
5. Stagger the laps of the metal foil flashing layer from lap seams in the reinforcing layer. Extend the flashing sheet a minimum of 4" beyond the toe of the cant onto the prepared surface of the finished roof and up the wall to the desired flashing height.

3.06 EXERT PRESSURE ON THE FLASHING SHEET DURING APPLICATION TO ENSURE COMPLETE CONTACT WITH THE WALL/ROOF SURFACES, PREVENTING AIR POCKETS; THIS CAN BE ACCOMPLISHED BY USING DAMP SPONGE OR SHOP RAG. CHECK AND SEAL ALL LOOSE LAPS AND EDGES. NAIL THE TOP EDGE OF THE FLASHING ON 6" O.C..

A. Flashing Application — Wood Surfaces:

1. Inspect the nailer to assure proper attachment and configuration.
2. Flash wood or plywood parapet walls and curbs using the reinforced sheet and metal foil flashing membrane.
3. The reinforcing sheet shall have minimum 3" side laps and extend a minimum of 3" onto the base ply surface and to the top of the parapet wall, curb, etc.
4. Nail the reinforcing sheet through the field of the sheet to the vertical wood surface 12" O.C. from the top of the cant to the top of wall curb, etc.
5. Fully adhere the remainder of flashing reinforcing sheet that extends over the cant and roof level.
6. After the finish ply has been applied to the top of the cant, prepare the surface area that is to receive primer to dry thoroughly.
7. Torch apply the metal foil-faced flashing into place using 36" widths (cut off the end of roll) always lapping the factory selvage edge.
8. Extend the flashing sheet a minimum of 4" beyond the toe of the cant onto the prepared surface of the finished roof and up the wall to the desired flashing height.
9. Exert pressure on the flashing sheet during application to ensure complete contact with the wall/roof surfaces, preventing air pockets; this can be accomplished by using a damp sponge or shop rag.
10. Check and seal all loose laps and edges.
11. Nail the top edge of the flashing 6" O.C.

B. Projection Flashing:

1. Plumbing Vents: soil vent stack pipes shall receive lead flashings installed in accordance with practices set forth in the NRCA Roofing Manual. The lead shall be carried up and over the top of the stack, and crimped down into the pipe to form a watertight seal. Projections shall be flashed as recommended by the roof membrane manufacturer. Provide tapered edge strips around base. Strip- in flange with specified stripping.
2. Square Projections: strip in all flanges on square projections with specified stripping ply. Prime all flanges prior to setting in a bed of mastic. Install to manufacturer's specifications. Provide tapered edge strips around base. Cricket up-side slope.
3. Round Projections: Strip in all flanges on round projections with specified stripping ply. Prime all metal prior to setting in mastic. Install to manufacturer's specifications. Provide tapered edge strips around base.

C. Wall and Curb Flashings:

1. The flashing substrate shall be free of all dirt and loose material.
 2. The underlayment ply of plies shall be brought to the top of the cant strip and adhered.
 3. Starting on the roof at least 6" from the roof side edge of the cant strip, adhere two (2) plies of flashing extending over the cant and up the vertical a minimum of 8".
 4. Each lap of the ply sheet shall be a minimum of 3".
 5. Starting two (2) inches past the flashing plies, install one (1) ply of SBS flashing membrane in hot asphalt.
 6. Laps shall not coincide with previously installed plies.
 7. The top of the SBS flashing shall be 1" past the previously installed plies above the cant strip.
 8. Fasten the top edge of the flashing on 6" centers using approved termination bar and fasteners. An NRCA-approved metal counter flashing shall extend down over the flashing a minimum of 4".
 9. Cricket the up—side slope of all curb projections.
- D. Overnight Seal/Water Out-Off:
1. Over Night Seal: Shall be performed according to accepted roofing practice as outlined in the NRCA Roofing Manual.
 2. Water Cut-Off: At the end of day's work or when precipitation is imminent, construct a water cut-off at all open edges.
 3. Cut-offs can be built using asphalt or plastic cement and roofing felts, constructed to withstand protracted periods of service.
 4. Cut-offs must be completely removed prior to resumption of roofing.

3.07 PIPE BOXES WITH COVERS AND FLANGED PENETRATIONS

- A. Run all plies up to the penetration.
- B. Pipe Boxes shall be at least 6" deep. The pipe box should extend at least 1" beyond the penetration in all directions. All corners and seams should be soldered tight and watertight.
- C. Place the pipe boxes over the penetration and prime all flanges.
- D. Strip in flange of the pipe boxes with one ply of base ply. Extend 6" onto field of roof.
- E. Install second layer of stripping membrane extending 9" onto field of roof.
- F. Install modified roof membrane.
- G. Fill pitch pan half full with non-shrink grout. Let this cure and top off with elastomer.
- H. Caulk joint between roof system and pitch pan with roof cement.
- I. Place a water-shedding bonnet over the top of the pitch pocket and clamp the top with a draw-band collar. Caulk the upper edge of the band with sealant.

3.08 FLASHING MEMBRANE INSTALLATION

- A. All curb, wall and parapet flashings shall be sealed with an application of mastic and mesh on a daily basis. No condition should exist that will permit moisture entering behind, around, or under the roof or flashing membrane.
- B. Prepare all walls, penetrations and expansion joints to be flashed and where shown on the drawings, with asphalt primer at the rate of one gallon per 100 square feet Allow primer to dry tack free.
- C. The two ply modified flashing system will be used as the flashing membrane and will be adhered to the underlying substrate by heat fusing unless otherwise noted in these specifications and nailed off 6" O.C. at all vertical surfaces.
 1. All base flashing shall extend up wall or curb in the machine direction of the membrane. All base flashing shall be terminated with a termination bar at 8" O.C.. and sealed at the top with a three course application of asphalt mastic and PVC mesh.

- D. The entire sheet of flashing membrane must be solidly adhered to the substrate.
- E. Counter flashing, cap flashings, expansion joints, and similar work to be coordinated with modified bitumen roofing work are specified in other sections.
- F. Roof accessories, miscellaneous sheet metal accessory items, including piping vents and other devices to be coordinated with modified bituminous roof system work are in other sections.

3.09 ROOF METAL AND ACCESSORIES

- A. Refer to Section 07 7200 - Roof Accessories.
- B. Coordinate all interfacing work as required to meet requirements of roofing manufacturer.

3.10 FINAL INSPECTION

- A. At completion of roofing installation and associated work, meet with Installer, installer of associated work, Architect, roofing system manufacturer's representative, and other representatives directly concerned with performance of roofing system.
- B. Walk roof surface areas of the building, inspect perimeter building edges as well as flashing of roof penetrations, walls, curbs and other equipment. List all items requiring correction or completion and furnish copy of list to each party attending.
- C. The Roofing System Manufacturer reserves the right to request a thermographic scan of the roof during final inspection to determine if any damp or wet materials have been installed. The thermographic scan shall be provided by the Roofing Contractor at a negotiated price.
- D. If core cuts verify the presence of damp or wet materials, the Roofing Contractor shall be required to replace the damaged areas at his own expense.
- E. Repair or replace (as required) deteriorated or defective work found at time above inspection to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- F. The Contractor is to notify the Owner upon completion of corrections.
- G. Following the final inspection, acceptance will be made in writing by the material manufacturer.

3.11 CLEANING AND PROTECTION

- A. Leave all areas around job site free of trash, debris, roofing materials, equipment, and related items after completion of the project.
- B. Remove bitumen stains from walls, walkways and driveways.
- C. Finished roof areas shall be protected from damage by the contractor during construction.

END OF SECTION

SECTION 07 6200
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. All sheet metal flashing and metal thru-wall flashing as indicated on the Drawings and required for a complete installation.
- B. Include all shop and field formed sheet metal work shown on drawings, specified or required, including, but not limited to:
 - 1. Roof penetration sleeves, hood and umbrella counter flashing. 02 Metal counter flashing and thru-wall flashing.
 - 2. Expansion joints.
 - 3. Roof Drains
 - 4. Scuppers.
 - 5. Metal perimeter roof edge flashing.
 - 6. Metal gravity vents.
 - 7. Metal thru-wall flashing receiver
 - 8. Copings, trim and miscellaneous sheet metal flashing and accessories.

1.02 RELATED WORK:

- A. Section 03 52 16 - Lightweight Insulating Concrete.
- B. Section 05 3123 - Steel Roof Decking.
- C. Section 07 7200 - Roof Accessories.
- D. All sections of Work relating to or affecting the roof system, including mechanical, plumbing and electrical items.
- E. All work shall be coordinated with the specified roofing system in accordance with roofing system manufacturer's standards and requirements.
 - 1. Sheet metal flashing shall be included as a component of the roofing system warranty.
 - 2. Work to be performed by the roof membrane contractor.

1.03 SUBMITTALS

- A. Review and comply with all provisions of section 01 3300 — Submittals
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 1. Show profiles, sizes, spacing and locations of assembled components.
 - 2. Show details of shop fabrications, connections and details.
 - 3. Show details of field fabrications, connections and details.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 1. Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 2. Generic details that do not depict actual conditions shall not be acceptable.
- E. Color / Finish Samples:
 - 1. Provide two (2) samples of each finish for selection by the Architect.
 - 2. Finish samples shall be provided of/ on actual material; paper or digital samples shall not be accepted.

3. Minimum size shall be 3" x 3", but must be large enough to convey attributes of the proposed product.

1.04 REFERENCES

- A. American Society of Testing and Materials (ASTM):
 1. ASTM A653/A653M-06 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
 2. ASTM A792/A792M Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 3. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 4. ASTM E283 Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 5. ASTM E331 Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
 6. ASTM E646 Standard Test Method for Tensile Strain-Hardening Exponents (n-values) of Metallic Sheet Materials.
 7. ASTM E1592 Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
 8. ASTM E1680 Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.
 9. ASTM E2140 Standard Test Method for Water Penetration of Metal Roof Panel Systems by Static Water Pressure Head.
- B. National Association of Architectural Metal Manufacturers (NAAMM).
- C. Roofing and Waterproofing Manual.
- D. Sheet Metal and Air Conditioning Contractors National Associate, Inc. (SMACNA):
01Architectural Sheet Metal Manual.
- E. ANSI / SPRI / FM 4435 / ES-1 "Wind Test Design Standard for Edge Systems Used with Low Slope Roofing Systems"

1.05 QUALITY ASSURANCE

- A. Single source responsibility: Fabricator of roof-related flashing and accessories shall be from a single source supplier.
 1. Provide products from an acceptable manufacturers with a minimum of five (5) years of satisfactory experience in sheet metal flashing fabrication.
- B. Sheet metal flashing that interfaces with the roofing system shall be installed by the roof installer.
 1. Coordinate as required for proper installation and interface in accordance with the roofing system manufacturer.
 2. Coordinate all sheet metal flashing associated with the specified roof system with the roof manufacturer and installer to assure compatibility.
 3. Where roofing membrane or cap sheet is adhered to the sheet metal flashing, provide primer, surfacing or other coating as required by the roofing manufacturer for proper interface and adherence to the roofing warranty requirements.
- C. Comply with governing codes and regulation of authorities having jurisdiction.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver, handle and store materials in accordance with manufacturer's instructions.
- B. Handle and store materials and equipment in such a manner to avoid damage.
 1. All damaged materials shall be removed from site and replaced with new

- C. No storage of materials shall be permitted on roof areas other than those materials that are to be installed the same day.
 - 1. Any exception must be in written form.
 - 2. Do not place materials or equipment in such a manner as to overload structure.

1.07 WARRANTY

- A. Roofing Contractor's Warranty:
 - 1. Contractor shall warrant the sheet metal work and related work to be free from defects in workmanship and materials, and that the metal flashings will be and remain watertight, for a period of five (5) years from date of Substantial Completion.
 - 2. Defects shall include, but not be limited to:
 - a. Leaking water or bitumen within building or construction.
 - b. Becoming loose from substrate.
 - c. Loose or missing parts.
 - d. Finish failure as defined above.
 - 3. Correction may include repair or replacement of failed products.
 - 4. Warranty shall state that defects of the sheet metal occurring during the warranty period that cause damage to the building interior or exterior shall be promptly addressed by the contractor within a maximum of forty-eight (48) hours after notification.
- B. Manufacturer's Product Finish Warranty:
 - 1. Manufacturer's standard twenty (20) year Kynar 500 Finish warranty signed by the manufacturer, guaranteeing covering failure of the fluoropolymer finish during the warranty period.
 - 2. Failure is defined to include, but not be limited to:
 - a. Deterioration of finish, such as fading, discoloring, peeling, cracking, corroding, etc.
 - 3. Correction shall include replacement of defective / failed products.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturers / fabricators providing sheet metal flashing shall meet or exceed the following requirements:
 - 1. Their products meet or exceed the specifications.
 - 2. Fabricator has a minimum of five (5) years' experience manufacturing products of the type specified.
 - 3. Products have been tested in conjunction with roofing system as an assembly and as such have obtained the same approval and rating as the roofing membrane system.
 - 4. Products are approved for use by the roofing system manufacturer.
- B. Manufacturers / fabricators shall coordinate with the roofing system manufacturer to assure compatibility and proper interface with the roofing system manufacturer's standards and requirements.

2.02 SHEET METAL MATERIALS

- A. General Requirements: roofing sheet metal system shall have been tested in conjunction with roofing system as an assembly and have the same approval and rating as the roofing system.
- B. Stainless Steel:
 - 1. Conforming to ASTM A167 and A240/A240M.
 - 2. Type 302/304 Soft Temper.
 - 3. No. 2D finish.
 - 4. Minimum thickness 24 gauge, except as otherwise noted.
- C. Prefinished Aluminum Sheet:
 - 1. Precoated type, aluminum conforming to Fed. Spec. QQ-A-250, ASTM B209

2. Finish: Kynar 500 or Hylar 5000 in color as specified by Architect from manufacturer's standard colors.
 3. Thickness: minimum 0.040 inch, except as otherwise indicated.
- D. Sheet Lead:
- a. Comply with FS QQ-L-201, Grade B.
 - b. Four (4) pound minimum for use as sanitary vent flashing.
 - c. Four (4) pound minimum for use at roof drains and soil stacks.
- E. Finish: Finish for all exposed sheet metal work shall be a premium, factory applied / baked on PVDF paint finish using a Kynar 500 resin base, containing a minimum of 70% fluoropolymer, meeting AAMA 2605-98 standards.
1. BASF "Fluoroceram".
 2. PPG Industries "Duranar".
 3. The Velspar Corporation "Fluopon".
 4. Color on finish side shall be as selected by the Architect from the manufacturer's standard colors. Color on concealed side shall be manufacturer's option.
 5. Provide a strippable, protective coating material on all finished portions of pre-finished flashing; to be removed following installation.
 6. All sheet metal fascia, gutters and downspouts shall be pre-finished aluminum. All metal flashing embedded in roof membrane and in through-wall conditions shall be stainless steel.

2.03 FASTENERS

- A. Fasteners shall be same metal as flashing/sheet metal, or other non-corrosive metal as recommended by sheet manufacturer for the specific application. Match finish of exposed heads with material being fastened.
- B. Exposed fasteners shall be self-sealing and gasketed for weather tight installation. (ZAC type).
- C. Match finish of exposed heads with material being fastened.
- D. Mechanical fasteners:
1. Nails: Stainless steel, ring-shank, minimum 1-1/2 inches in length with 3/8 inch diameter head.
 2. Washers: steel washers with bonded rubber sealing gasket.
 3. Screws: self-tapping sheet metal type of stainless steel or compatible with material being fastened, with integral EPDM washers.
 4. Rivets: stainless steel and cadmium plated material, closed end type of sizes recommended by sheet metal manufacturer to suit application.
 5. Provide 300 series stainless steel.
 6. Clips: Clips should be minimum 0.050-inch aluminum or 20-gauge stainless steel.

2.04 RELATED MATERIALS

- A. Solder: ASTM B32, flux type and alloy composition as required and recommended by the manufacturer for the metals to be soldered.
- B. Flux:
1. Phosphoric acid type, manufacturer's standard.
 2. For use with stainless steel: acid-chloride type flux, except use rosin flux over tinned surfaces.
- C. Adhesives: type recommended by flashing sheet manufacturer seaming and adhesive application of flashing sheet to ensure adhesion and water tightness.

- D. Metal Accessories: sheet metal clips, straps, anchoring devices, clamps and similar accessories required for the complete installation of work, matching or compatible with material being installed, non-corrosive, size and gauge recommended by installer to suit application and performance.
- E. Sealant:
 - 1. Type A:
 - a. Type: one-part, non-sag, moisture-curing polyurethane sealant.
 - b. Approved Products/Manufacturers: "Chem-Calk 900" manufactured by Bostik Construction Products Division, "Vulkem 921" manufactured by Mameco International, Inc., "Dynatrol 1" manufactured by Pecora Corporation, "NP 1" manufactured by Sonneborn Building Products, or approved equal.
 - 2. Type B:
 - a. Type: one-part, neutral-curing, medium-modulus silicone sealant for sealing metal to metal surfaces, i.e. metal edge, cover plates, etc.
 - b. Approved Products/Manufacturers: "Chem-Calk 1200" manufactured by Bostik Construction Products Division, "795 Silicone Building Sealant" manufactured by Dow Corning Corporation, "895 Silicone" manufactured by Pecora Corporation, "Omniseal" manufactured by Sonneborn Building Products, "Spectrem 2" manufactured by Tremco Incorporated, or approved equal.
- F. Pitch Pan Filler:
 - 1. Type: pourable polyurethane sealer, approved by roofing system manufacturer.
 - 2. Approved Products/Manufacturers: "Quick Pitch Sealer" manufactured by U.S. Intec, "SPM Pourable Sealer" manufactured by Johns Manville, or approved equal.
- G. Termination Bar:
 - 1. Material: extruded aluminum bar with flat profile.
 - 2. Size: 1/8 inch thick by one (1) inch wide with factory punched oval holes spaced six (6) inches on center.
 - 3. Approved Products/Manufacturers: "TB 125" manufactured by TruFast Corp. or approved equal.
- H. Pipe Hangers and Supports: Refer to Section 077200 — Roof Accessories.
- I. Splash Pans: 22 gauge stainless steel, of size and profiles indicated. Use at locations where roof drainage discharges onto lower roof.
- J. Splash blocks: concrete, type, of size and profiles indicated; minimum 3,000 psi compressive strength at 28 days, with minimum five (5) percent air entrainment. Use at locations where roof drainage dumps on ground.
- K. Thru-wall flashing receiver: 24 ga. Stainless steel 2D finish
- L. Downspout Boots:
 - 1. Approved products: Cast Aluminum by Barry Pattern & Foundry; Style B25A or Cast Iron by Neenah Foundry Company, Series R-4929 or pre- approved equal.
 - 2. Provide downspouts boots in size and configuration as shown on drawings or as required for pipe sizes and down spout sizes. Minimum 36" length.
 - 3. Separate dissimilar metal, where applicable.

2.05 FABRICATION

- A. Except as otherwise indicated, fabricate work in accordance with SMACNA Architectural Sheet Metal Manual and other recognized industry practices and reviewed shop drawings. Form all flashings, receivers and counter flashings in accordance with standards set forth in the NRCA roofing manual and SMACNA.
- B. Comply with manufacturer's installation instructions and recommendations.

- C. Shop fabricate work to greatest extent possible. Fabricate inside and outside corners for metal edges, counter flashing, and coping caps.
- D. Fabricate items to size and dimensions as indicated on the drawings. Limit single piece lengths to ten (10) feet.
- E. Fabricate for waterproof and weather-resistant performance; with expansion provisions for running work sufficient to permanently prevent leakage, damage or deterioration of the work.
- F. Integrate flashing in a manner consistent with detailing. Form work to fit substrates.
- G. Make angle bends and folds for interlocking metal with full regard for expansion and contraction to avoid buckling of fullness in metal after installation.
- H. Fabricate items with straight lines, sharp angles, smooth curves, and true levels. Avoid tool marks, buckling and oil canning.
- I. Fold back edges on concealed side of exposed edge to form hem.
- J. Unless noted otherwise, lap joints minimum one (1) inch. Rivet and solder joints on parts that are to be permanently and rigidly assembled.
- K. Seams:
 - 1. Wherever possible, fabricate non-moving seams in sheet metal with flat- lock seams and end joints.
 - 2. Pre-finished metal: seal pre-finished metal seams with rivets and silicone sealant.
 - 3. Metal other than aluminum: tin edges to be seamed, form seams, and solder.
- L. On Kynar 500 pre-finished metal, surface sand flanges prior to applying any primers. Prime all metal in contact with bituminous material.
- M. Back paint all concealed metal surfaces with bituminous paint where expected to be in contact with cementitious materials or dissimilar metal.
- N. Expansion Provisions: where lapped or bayonet type expansion provisions in work cannot be used or would not be sufficiently waterproof or weatherproof, form expansion joints of intermeshing hooked flanges, not less than one (1) inch deep filled with mastic sealant concealed within joints.
- O. Unless noted otherwise, fabricate perimeter edge/fascia, scuppers, gutters, downspouts, copings, and trim from pre-finished aluminum sheet. Gutters shall slope to downspout location(s).
- P. Fabricate corners from one piece with maximum 48-inch-long legs. Seam and seal prefinished steel, solder stainless steel.

2.06 FABRICATED ITEMS

- A. Metal Flashings:
 - 1. Through wall receiver tray: minimum 24 gauge stainless steel. Fabricate receiver tray to full depth of wall cavity, solder all joint and end dams.
 - 2. Counter flashing: minimum 24 gauge stainless steel, unless otherwise shown on drawings.
- B. Wind Clips: minimum 24 gauge stainless steel (or match material of counter flashing), one (1) inch wide by length to engage counter flashing a minimum of
 - 1. ½" inch.
- C. Roof Penetrations:
 - 1. Umbrella counter flashing: two-piece construction of minimum 22 gauge stainless steel, fabricated in accordance with drawings or project requirements.
- D. Flashing pans:
 - 1. 24 gauge stainless steel.

2. Fabricate to provide installed minimum clear inside perimeter dimension of two inches on each side of penetration element.
 3. Fabricate pans to at least six inches above the finished roof membrane and with $\frac{1}{4}$ inch hem at tope edge and with four inch flanges. Round all corners of flange.
 4. Fabricate metal bonnets for all pans, NO EXCEPTIONS. Fabricate bonnets with metal compatible with metal to which bonnet is to be attached. On beams and other steel, weld in place bonnets fabricated from $\frac{1}{4}$ inch steel plate. Draw band bonnets fabricated from 22 gauge stainless steel may be used on circular projections.
- E. Metal Edge:
1. Minimum 0.040 inch thick pre-finished aluminum formed in maximum ten foot lengths, with six inch wide cover plates of same profile, four inch flange.
 2. Provide expansion slip joints a maximum 10 feet on center.
 3. Shop fabricate all interior and exterior corners. Fabricate exterior corners with 18 inch minimum to four foot maximum legs. Lap, rivet, and seal prior to delivery to jobsite.
 4. Fabricate to sizes and dimensions as indicated on drawings with a minimum one inch coverage past top of wall. Refer to SMACNA Fig. 2- 5A.
 5. Provide mock-up for Architect's approval prior to fabrication.
 6. Maximum 7-inch fascia, including a $\frac{3}{4}$ " inch gravel stop, unless indicated otherwise on drawings.
 7. Metal edge to have continuous cleat, 0.050 aluminum installed in maximum 10 foot lengths with minimum $\frac{1}{4}$ " end gap between joints fastened with stainless steel ring shank nails 6" o.c. as low as possible on the face. Cleat joints shall be staggered from fascia joints.
 8. Fascia shall be fabricated and installed to comply with ANSI/SPRI ES-1 standards
- F. Vent Hoods, Sleeves, Penetration Flashings, and Accessories: Minimum 24 gauge stainless steel, or as shown or directed otherwise.
- G. Coping:
1. 0.040" thick pre-finished aluminum, with standing seam joints of same profile.
 2. Fabricate as outlined in SMACNA; refer to Figure 3-4A.
 3. Provide tapered substrate to slope to one side and cover with waterproof membrane.
 4. Install with continuous cleat on front side and fasten 6" o.c.
- H. Pipe Box Cover: 22 gauge stainless steel.
- I. Heat Exhaust Curbs and Hoods: 22 gauge stainless steel.
- J. Expansion joint cover: Shop-built, minimum 24 gauge, standing-seam, stainless steel. Provide pre-finished aluminum metal at perimeter edge and termination. Last 10 feet of expansion joint to match color of gravel guard.
- K. Angle Termination Bar: 1" x 1" x 0.040" aluminum
- L. Vent Pipe Flashing: 4 lb. lead. Provide proper size to fold down inside of pipe a minimum of 1". Caulk top of vent prior to folding lead in.
- M. Roof Drain Flashing: 4 lb. lead minimum 30" x 30"
- N. Thru-wall Flashing Receiver: Stainless Steel 24 gauge, 2D finish.
1. Ten foot (10'-0") lengths with 6" cover plates bedded in caulk. 02 Corners 24" max., 18" min., weld or solder.
 2. One (1) inch leg turned up the back wall and flashed.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify substrates are smooth and clean to extent required to perform sheet metal work.
 - B. Verify roof openings, curbs, pipes, sleeves, ducts or vents through roof are solidly set in place.
-

- C. Verify that reglets, nailers, cants, and blocking to receive sheet metal are in place and free of concrete and soil.
- D. Do not start work until conditions are satisfactory.

3.02 PREPARATION

- A. Field measure site conditions prior to fabrication work.
- B. Install starter and edge strips and cleats before starting installation.

3.03 INSTALLATION

- A. Install sheet metal with lines, arises, and angles sharp and true, and plane surfaces free from objectionable wave, warp, or buckle. Exposed edges of sheet metal shall be folded back to form a ½" hem on concealed side from view. Finished work shall be free from water retention and leakage under all weather conditions. Pre-fabricated corners or transitions are required at changes in direction, elevation, or place and at intersections. Locate field joints not less than 12" nor more than 3' from actual corner. Laps shall be 1", riveted and soldered at following locations:
 - 1. Pre-fabricated corners.
 - 2. Transitions.
 - 3. At intersections.
- B. Anchor units of work securely in place to prevent damage or distortion from wind or buckling. Provide for thermal expansion of metal units; conceal fasteners wherever possible, and set units true to line an level as indicated. Install work with laps, joints, and seams which are permanently watertight and weatherproof.
- C. Install fabricated sheet metal items in accordance with manufacturer's installation instruction and recommendations and with SMACNA Architectural Sheet Metal Manual.
- D. Separations: provide for separation of metal from dissimilar metal or corrosive substrates by coating concealed surfaces with zinc chromate, bituminous coating, or other permanent separation locations of contact as recommended by manufacturer of fabricator. Do not use materials which are incompatible with roofing system.
- E. Continuous cleat: at exposed edges of perimeter edge, fascias, cap flashings, and where required, attach continuous cleat at 6" on center with appropriate fastener.
- F. Gravel guard/fascia:
 - 1. Install with expansion joints 10' on center, ½" expansion leeway, with cover plate.
 - 2. Set in asphalt mastic and fasten into nailer at 3" on center, staggered.
 - 3. Buff sand Kynar surface of flange and prime.
 - 4. Strip in flange with specified stripping plies in hot bitumen extending 6" from the outer edge of the flange and butt base of gravel stop.
- G. Counter Flashing:
 - 1. Do not use surface mount counter flashing.
 - 2. Set in through wall with receiver and spring lock counter flashing, as detailed in drawings and to NRCA roofing manual, SMACNA standards.
 - 3. Coordinate installation of through wall flashing with the masonry contractor.
 - 4. Seal through wall in conjunction with masonry wall waterproofing.
 - 5. Install wind clips 30" on center at all counter flashing over 5' in length.
- H. Pitch Pans:
 - 1. Apply mastic under pitch pan flange.
 - 2. Prime all metal flanges with asphalt primer prior to flashing installation.
 - 3. Clean all projection enclosed in pitch pans in any manner suitable and coated with a rust inhibitive coating as approved by the Architect. Coating shall be allowed to dry prior to pitch pan fill.

4. Fill base of pitch pans with grout or cementitious binder and allow to cure. 05 Top finish fill: self-leveling, one part urethane, at least 2" to top of pitch pan sides.
 5. Strip in flange with specified stripping plies in hot bitumen extending 6" from the outer edge of the flange and butt base of pitch pan.
- I. Roof Drains:
1. After membrane installation, prime bottom of lead flashing sheet and set in uniform bed of plastic roof cement at specified locations.
 2. Extend lead flashing into drain bowl or pipe a minimum of 2" and over top of piping/bowl connections, if possible. Apply a continuous bead of specified Type A sealant, at intersection of pipe and drain bowl.
 3. If drain bowl and pipe connection is contaminated with bituminous materials, strip-in area with 3 coursing of plastic roof cement and fabric.
 4. Prime top of lead flashing sheet to receive strip-in membrane.
- J. Pipe Box:
1. Fully solder joints and connections.
 2. Height shall be 6" minimum above roof surface.
 3. Install with flanges set in plastic roof cement on roof membrane.
 4. Fill pans with grout to a height of 3/4 of the total pan height.
 5. Fill remaining height of pitch pans with specified pitch pan filler.
 6. Install hood over pan securing to each side with self-tapping screws.
 7. Install face plate to cover box opening around pipe penetrations.
- K. Sanitary Vent Stacks:
1. Prime top and bottom flanges of lead flashing sleeve. Set flange in uniform troweling of plastic roof cement. Prime top side of flange to receive strip-in membrane.
 2. Fold lead sleeve down inside of pipe a minimum of 1". Apply a continuous bead of sealant on inside of pipe prior to folding lead sleeve.
- L. Expansion Joint:
1. Construct wood curbs as shown on drawings using materials specified in Section 07 5216 — SBS Modified Membrane Roofing or if not specified there, use materials specified in Section 06 1000— Rough Carpentry.
 2. Install underlayment, form envelope, and secure underlayment to curb. Fill envelope with compressible insulation.
 3. Securely fasten expansion joint cover to curb with grommet type fasteners spaced 6" on center.
 4. Taper expansion joint down at the metal edge.
 5. Shall be installed as detailed on drawings and as outlined in the NRCA Roofing Manual and SMACNA.
- M. Coping:
1. Install wood nailers as shown on drawings.
 2. Install metal cleats with appropriate fasteners spaced 6" on center.
 3. Install underlayment over the wood substrate. Lap ends minimum of 6" and secure membrane in place. Seal laps with appropriate adhesive.
 4. Install metal coping allowing 1/2" spaces between segments.
 5. Lock coping onto cleat and install appropriate fasteners through the interior fascia space 24" on center in enlarged holes.
 6. Install appropriate fastener through neoprene washer and cover plate between coping segments.

7. Accommodate building wall expansion joints by terminating coping joints and cleats either side of expansion joint. Do not run coping or cleats continuous across joints. Install coping cover plate to span across joint and lap coping on each side of joints a minimum of 4". Fasten cover plate on one side of joint only. Provide wall flashing membrane up and over parapet wall in accordance with manufacturer's detail.

3.04 CLEANING AND PROTECTION

- a. Remove flux and residual acid immediately by neutralizing with baking soda and washing with clean water. Leave work clean of stains.
- b. Remove scraps and debris and leave work area clean.
- c. Clean exposed metal surfaces, removing substances which might cause corrosion of metal or deterioration of finishes. Paint areas where finish is damaged on pre-finished metal by painting with a compatible paint in color to match undamaged finish.
- d. Prime soldered area of phosphatized metal after cleaning to prevent rusting.
- e. Paint metal flashings that have been soiled with bitumen with aluminized paint.
- f. Clean other work damaged or soiled by Work of this Section.
- g. Protect finished work from damage.

END OF SECTION

**SECTION 07 7200
ROOF ACCESSORIES**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Roof equipment curbs.
- B. Roof equipment supports.
- C. Pipe supports.

1.02 RELATED WORK:

- A. Section 05 1200 - Structural Steel Framing.
- B. Section 05 2100 - Steel Joist Framing.
- C. Section 07 3123 - Steel Roof Decking.
- D. Section 07 5216 – SBS Modified Membrane Roofing.

1.03 SUBMITTALS

- A. Review and comply with all provisions of section 01 3300 -Submittals
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 1. Show profiles, sizes, spacing and locations of assembled components.
 - 2. Show details of shop fabrications, connections and details.
 - 3. Show details of field fabrications, connections and details.
 - 4. Provide calculations demonstrating compliance with wind load and other requirements.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - a. Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - b. Generic details that do not depict actual conditions shall not be acceptable.
- E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 1. Include recommended cleaning products and instructions for use.
 - 2. Where applicable, provide recommended maintenance schedules and procedures.
- F. Operations and Maintenance Manuals:
 - a. Provide complete operations and maintenance manuals to the Owner.
 - b. O & M manuals must be reviewed, accepted and delivered to the Owner prior to Owner demonstration(s).

1.04 INSTALLATION RESPONSIBILITY

- A. In addition to the items normally a part of this Section, coordinate the installation of roof accessory curbs and pipe flashings and equipment supports that may be specified elsewhere.
- B. Coordinate the work specified herein with the following work:
 - 1. Roofing.
 - 2. Roofing Sheet Metal.
 - 3. Mechanical Equipment.
 - 4. Plumbing.
 - 5. Light Weight Insulating Concrete.

PART 2 - PRODUCTS

2.01 PREFABRICATED ROOF CURBS

- A. Design of roof curbs is based on products manufactured by Thybar Corporation.
 - 1. Acceptable manufacturers: The following manufacturers are acceptable to provide Roof Curbs provided proposed product(s) meet or exceed all specified requirements.
 - a. The Pate Co.
 - b. Custom Curb, Inc.
- B. Curbs: Design is based on Thybar model TC-3 series roof curbs.
 - 1. Manufactured of galvanized steel meeting ASTM A653 / A653M.
 - a. Construction Gauge: Minimum 16 gauge; and heavier where required by size and / or load of equipment. Coordinate as required.
 - 2. All seams shall be welded continuous to be water and air tight.
 - 3. Roof curb perimeter shall have a continuous 2" minimum horizontal leg at base for secure attachment to supporting steel framing.
 - 4. Height: As required to provide a minimum 8" above highest interfacing roof deck. Coordinate with roofer to confirm.
 - 5. Curbs shall be fabricated for level tops, accounting for pitch of roof steel framing / roof deck as required.
 - 6. Provide additional angle reinforcing at maximum 48" O.C. as required to support equipment.
 - 7. All curb walls shall be insulated with minimum 1-1/2" thick 3PCF rigid insulation. Provide interior, protective, sheet metal liner to cover rigid insulation.
 - 8. Factory installed wood nailers; minimum 1-1/2" x 1-1/2".
- C. Counter Flashing Cap: Minimum 18 gauge stainless steel.
- D. Coordinate with other trades as required for exact sizes of roof curbs required and load at each location.
- E. Pipe Flashing Curbs:
 - 1. Same type of construction as roof curbs above.
 - 2. Pipe Seals: ABS cover with graduated neoprene or chlorinated polyethylene boot with two (2) stainless steel adjustable clamps per pipe boot.
 - 3. Coordinated with other trades as required for exact sizes, pipe quantities and pipe diameters.

2.02 EQUIPMENT SUPPORTS

- A. Design of equipment supports is based on products manufactured by Thybar Corporation.
 - 1. Acceptable manufacturers: The following manufacturers are acceptable to provide Roof Curbs provided proposed product(s) meet or exceed all specified requirements.
 - a. The Pate Co.
 - b. Custom Curb, Inc.
- B. Equipment Supports: Design is based on Thybar model TEMS-3 series equipment supports.
 - 1. Manufactured of galvanized steel meeting ASTM A653 / A653M.
 - 2. Construction Gauge: Minimum 18 gauge; and heavier where required by size and / or load of equipment. Coordinate as required.
 - 3. Nominal width: 5".
 - 4. All seams shall be welded continuous to be water and air tight.
 - 5. Equipment supports perimeter shall have a continuous 2" minimum horizontal leg at base for secure attachment to supporting steel framing.
 - 6. Height: As required to provide a minimum 8" above highest interfacing roof deck. Coordinate with roofer to confirm.

7. Equipment supports shall be fabricated for level tops, accounting for pitch of roof steel framing / roof deck as required.
 8. Internal bulkhead reinforcement as required for imposed load.
 9. Factory installed, treated 2x6 wood nailer, continuous.
- C. Equipment Support Curb Caps: Minimum 18-gauge stainless steel.
- D. Coordinate with other trades as required for exact sizes of roof curbs required and load at each location.

2.03 PIPE SUPPORTS

- A. Design of pipe supports is based on products manufactured by PHP Systems / Design (PHPSD). NO SUBSTITUTIONS.
- B. Design of pipe supports is based on PHPSD Pipe Supports as follows:
1. Series SS-8 for lines 2-1/2" or less.
 2. Series PP-10 for lines up to 3-1/2".
 3. Series RB-18 for lines 4" to 6".
- C. Roller type pipe support specifically designed for installation without roof penetrations or flashing.
- D. Base Material: high density / high impact polypropylene with integral UV protection.
- E. Minimum 12 gauge, channel type steel framing with roller system. Hot dipped galvanized after fabrication.
- F. Provide accessory clamps, bolts, nuts, washers and other devices required for a complete installation.
- G. Provide protective traffic pads at each pipe support as recommended by roofing system manufacturer. Coordinate with other trades as required.
- H. Spacing of hangers not to exceed 6 feet on center.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Coordinate all trades as required for proper design, sizing and locations of equipment curbs and equipment supports.
1. Coordinate with steel fabrication and erection contractors to provide a continuous bearing all 4 sides of equipment curbs. Minimum size: 3-1/2x3-1/2 x 1/4" angle.
 2. Coordinate with steel fabrication and erection contractors to provide a continuous bearing all below sides of equipment supports. Minimum size: 3- 1/2x3-1/2 x 1/4" angle.
 3. Coordinate with roofing contractor for proper flashing and interface with equipment curbs and supports.
- B. Coordinate all trades as required for types, sizing and locations of roof ladder anchoring into exterior walls.
1. Set anchoring devices in place prior to installation of weather barrier to assure a weather-tight seal at anchors.

3.02 INSTALLATION

- A. Install all roofing according in strict accordance with manufacturer's printed instructions and final reviewed shop drawings.
- B. Coordinate with roofing operation for flashing and interface to provide a watertight installation.
- C. Install sealant conforming to FS TT-S-00227E, Type II, Class A, as required.

END OF SECTION

**SECTION 07 8100
APPLIED FIRE PROTECTION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fireproofing of interior structural steel not exposed to damage or moisture.
- B. Preparation of fireproofing for application of exposed finish specified elsewhere.

1.02 RELATED REQUIREMENTS

- A. Section 01 1400 - Work Restrictions
- B. Section 01 4533 - Code-Required Quality Control
- C. Section 05 1200 - Structural Steel Framing.
- D. Section 05 2100 - Steel Joist Framing.
- E. Section 05 3100 - Steel Decking.
- F. Section 07 8400 - Firestopping.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- B. ASTM E605/E605M - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 2019 (Reapproved 2023).
- C. ASTM E736/E736M - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members; 2019 (Reapproved 2023).
- D. ASTM E759/E759M - Standard Test Method for Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members; 1992 (Reapproved 2023).
- E. ASTM E760/E760M - Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members; 1992 (Reapproved 2023).
- F. ASTM E859/E859M - Standard Test Method for Air Erosion of Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members; 2023.
- G. ASTM E937/E937M - Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 1993 (Reapproved 2023).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with placement of ceiling hanger tabs, mechanical component hangers, and electrical components.
- B. Preinstallation Meeting: Convene two before starting work of this section.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittals procedures.
- B. Product Data: Provide data indicating product characteristics, performance criteria, and limitations of use.
- C. Test Reports: Reports from reputable independent testing agencies for proposed products, indicating compliance with specified criteria, conducted under conditions similar to those on project, as follows:
 - 1. Bond strength.
 - 2. Bond impact.
 - 3. Compressive strength.
 - 4. Fire tests using substrate materials similar those on project.

- D. Manufacturer's Installation Instructions: Indicate special procedures.
- E. Manufacturer Reports: Indicate environmental conditions that applied fireproofing materials were installed.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience
 - 1. Having minimum five years of documented experience.

1.07 MOCK-UP

- A. Construct mock-up, 100 square feet in size.
- B. Comply with project requirements for fire ratings, thickness, density of application, and code compliance.
- C. Locate where directed.
- D. Examine installation within one hour of application to determine variances from specified requirements due to shrinkage, temperature, and humidity.
- E. Where shrinkage and cracking are evident, adjust mixture and method of application as necessary; remove materials and re-construct mock-up.
- F. Mock-up may remain as part of the Work.

1.08 FIELD CONDITIONS

- A. Do not apply fireproofing when temperature of substrate material and surrounding air is below 40 degrees F or when temperature is predicted to be below said temperature for 24 hours after application.
- B. Provide ventilation in areas to receive fireproofing during application and 24 hours afterward, to dry applied material.
- C. Provide temporary enclosure to prevent spray from contaminating air.
- D. Do not allow roof traffic during installation of roof fireproofing and drying period.

1.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a two year period after Date of Substantial Completion.
 - 1. Include coverage for fireproofing to remain free from cracking, checking, dusting, flaking, spalling, separation, and blistering.
 - 2. Reinstall or repair failures that occur within warranty period.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Applied Fireproofing:
 - 1. Carboline Company: www.carboline.com.
 - 2. GCP Applied Technologies: www.gcpat.com/fireproofing.
 - 3. Isolatek International Corp: www.isolatek.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIREPROOFING ASSEMBLIES

- A. Provide assemblies as indicated on drawings.

2.03 MATERIALS

- A. Sprayed Fire-Resistive Material for Interior Applications, Concealed: Manufacturer's standard factory mixed material, which when combined with water is capable of providing the indicated fire resistance, and conforming to the following requirements:
 - 1. Bond Strength: 150 pounds per square foot, minimum, when tested in accordance with ASTM E736/E736M when set and dry.
 - 2. Dry Density: Minimum average density of 15 lb/cu ft, with minimum individual density of any test sample of 14 lb/cu ft, when tested in accordance with ASTM E605/E605M.
 - 3. Compressive Strength: 8.33 pounds per square inch, minimum.
 - 4. Effect of Impact on Bonding: No cracking, spalling or delamination, when tested in accordance with ASTM E760/E760M.
 - 5. Corrosivity: No evidence of corrosion, when tested in accordance with ASTM E937/E937M.
 - 6. Air Erosion Resistance: Weight loss of 0.025 g/sq ft, maximum, when tested in accordance with ASTM E859/E859M after 24 hours.
 - 7. Surface Burning Characteristics: Maximum flame spread index of 0 (zero) and maximum smoke developed index of 0 (zero), when tested in accordance with ASTM E84.
 - 8. Effect of Deflection: No cracking, spalling, or delamination, when tested in accordance with ASTM E759/E759M.

2.04 ACCESSORIES

- A. Primer Adhesive: Of type recommended by applied fireproofing manufacturer.
- B. Overcoat: As recommended by manufacturer of applied fireproofing material.
- C. Metal Lath: Expanded metal lath; minimum 3.4 pounds per square foot, galvanized finish.
- D. Water: Clean, potable.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive fireproofing.
- B. Verify that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.
- C. Verify that ducts, piping, equipment, or other items that would interfere with application of fireproofing have not been installed.
- D. Verify that voids and cracks in substrate have been filled.
- E. Verify that projections have been removed where fireproofing will be exposed to view as a finish material.

3.02 PREPARATION

- A. Perform tests as recommended by fireproofing manufacturer in applications where adhesion of fireproofing to substrate is in question.
- B. Remove incompatible materials that could effect bond by scraping, brushing, scrubbing, or sandblasting.
- C. Prepare substrates to receive fireproofing in strict accordance with instructions of fireproofing manufacturer.
- D. Apply fireproofing manufacturer's recommended bonding agent on primed steel.
- E. Protect surfaces not scheduled for fireproofing and equipment from damage by overspray, fall-out, and dusting.
- F. Close off and seal duct work in areas where fireproofing is being applied.

3.03 APPLICATION

- A. Install metal lath over structural members as indicated or as required by UL Assembly Design Numbers.
- B. Apply primer coating, fireproofing, and overcoat in accordance with manufacturer's instructions.
- C. Apply fireproofing in uniform thickness and density as necessary to achieve required ratings.
- D. In exposed locations, trowel surface smooth and form square edges, using tools and procedures recommended by fireproofing manufacturer.
- E. Apply overcoat at the rate recommended by fireproofing manufacturer.

3.04 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 4000 - Quality Requirements.
- B. The owner will employ an independent agency to randomly sample and verify the thickness and the density of the fireproofing in accordance with the provisions of ASTM E605 and verify the bond strength of the fireproofing in accordance with ASTM E736.
- C. Inspect installed fireproofing after application and curing for integrity, prior to its concealment.
- D. Ensure that actual thicknesses, densities, and bond strengths meet requirements for specified ratings and requirements of authorities having jurisdiction (AHJ).
- E. Re-inspect installed fireproofing for integrity of fire protection, after installation of subsequent Work.

3.05 CLEANING

- A. Remove excess material, overspray, droppings, and debris.
- B. Remove fireproofing from materials and surfaces not required to be fireproofed.
- C. At exposed fireproofing, clean surfaces that have become soiled or stained, using manufacturer's recommended procedures.

END OF SECTION

**SECTION 07 8400
FIRESTOPPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Firestopping systems.
- B. Firestopping of all joints and penetrations in fire-resistance rated and smoke-resistant assemblies, whether indicated on drawings or not , and other openings indicated.

1.02 RELATED REQUIREMENTS

- A. Section 01 1400 - Work Restrictions
- B. Section 01 4533 - Code-Required Quality Control
- C. Section 01 7000 - Execution and Closeout Requirements: Cutting and patching.
- D. Section 09 2982 - Gypsum Board: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).
- C. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2015b, with Editorial Revision (2016).
- D. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015 (Reapproved 2021)e1.
- E. ITS (DIR) - Directory of Listed Products; current edition.
- F. FM 4991 - Approval Standard for Firestop Contractors; 2013.
- G. FM (AG) - FM Approval Guide; current edition.
- H. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).
- I. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.
- J. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- C. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Certificate from authority having jurisdiction indicating approval of materials used.
- G. Installer Qualification: Submit qualification statements for installing mechanics.

1.05 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with ASTM E119 and ASTM E814.

1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
 2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
 3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section and:
1. Approved by Factory Mutual Research Corporation under FM 4991

1.06 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Firestopping Manufacturers:
1. 3M Fire Protection Products: www.3m.com/firestop/#sle.
 2. A/D Fire Protection Systems Inc: www.adfire.com/#sle.
 3. Everkem Diversified Products, Inc: www.everkemproducts.com/#sle.
 4. Hilti, Inc: www.us.hilti.com/#sle.
 5. Nelson FireStop Products: www.nelsonfirestop.com/#sle.
 6. Specified Technologies Inc: www.stifirestop.com/#sle.
 7. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
 8. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

- A. Firestopping Materials: Any materials meeting requirements.
- B. Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.
- C. Mold and Mildew Resistance: Provide firestopping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.
- D. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
- E. Fire Ratings: Refer to drawings for required systems and ratings.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.
- B. Head-of-Wall Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of floor or wall, whichever is greater.
- C. Floor-to-Floor, Wall-to-Wall, and Wall-to-Floor Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.

- D. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

2.04 FIRESTOPPING SYSTEMS

- A. Firestopping: Any material meeting requirements.
1. Fire Ratings: Use system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.
- B. Sealants or caulking materials for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:
1. Hilti FS-ONE Intumescent Firestop Sealant
 2. Hilti CP 604 Self-Leveling Firestop Sealant
 3. Hilti CP 620 Fire Foam
 4. Hilti CP 606 Flexible Firestop Sealant
 5. Hilti CP 601s Elastomeric Firestop Sealant
 6. 3M Fire Stop Sealant 2000
 7. 3M Fire Barrier CP25 WB
 8. Tremco Tremstop Fyre-Sil Sealant
- C. Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:
1. Hilti CP 601s Elastomeric Firestop Sealant
 2. Hilti CP 606 Flexible Firestop Sealant
 3. Hilti FS-ONE Intumescent Firestop Sealant
- D. Sealants, caulking or spray materials for use with fire-rated construction joints and other gaps, the following products are acceptable:
1. Hilti CFS-SP WB Firestop Joint Spray
 2. Hilti CP 601s Elastomeric Firestop Sealant
 3. Hilti CP 606 Flexible Firestop Sealant
 4. Hilti CP 604 Self-Leveling Firestop Sealant
 5. 3M Firestop Sealant 2000
 6. Tremco Tremstop Fyre-Sil Sealant
- E. Intumescent sealants or caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:
1. Hilti FS-ONE Intumescent Firestop Sealant
 2. 3M Fire Barrier CP25 WB
 3. Tremco Tremstop WBM Intumescent Firestop Sealant
- F. Intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, the following products are acceptable:
1. Hilti FS-ONE Intumescent Firestop Sealant
 2. Hilti CP 618 Firestop Putty Stick
 3. 3M Fire Barrier CP25 WB
 4. Tremco Tremstop WBM Intumescent Firestop Sealant
- G. Intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, the following products are acceptable:
1. Hilti FS-ONE Intumescent Firestop Sealant
 2. Hilti CP 618 Firestop Putty Stick
 3. 3M Fire Barrier CP25 WB

4. Tremco Tremstop WBM Intumescent Firestop Sealant
- H. Non curing, re-penetrable intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, the following products are acceptable:
 1. Hilti CP 618 Firestop Putty Stick
- I. Non curing, re-penetrable intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, the following products are acceptable:
 1. Hilti CP 618 Firestop Putty Stick
- J. Wall opening protective materials for use with UL listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:
 1. Hilti CP 617 Firestop Putty Pad
- K. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:
 1. Hilti CP 642 Firestop Collar
 2. Hilti CP 643 Firestop Collar
 3. Hilti CP 645 Firestop Wrap Strip
 4. 3M Fire Barrier PPD Plastic Pipe Device
- L. Cast-in place firestop devices for use with non-combustible and combustible plastic pipe (closed and open piping systems) penetrating concrete floors, the following products are acceptable:
 1. Hilti CP 680 Cast-In Place Firestop Device
 2. Hilti CP 681 Tub Box Kit for use with tub installations
- M. Materials used for large size/complex penetrations made to accommodate multiple steel and cooper pipes, electrical busways in raceways, the following products are acceptable:
 1. Hilti FS 635 Trowelable Firestop Compound
 2. Hilti FS 657 FIRE BLOCK
 3. Hilti CP 620 Fire Foam
 4. 3M Firestop Foam 2001
 5. 3M Fire Barrier CS-195 Composite Sheet
- N. Cables passing through fire-rated floors or walls shall pass through fire-rated wiring devices which contain an intumescent insert material that adjusts automatically to cable additions or subtractions.
 1. Hilti FS 657 FIRE BLOCK
 2. Specified Technologies Inc., EZ-PATH Fire Rated Pathway
- O. Sealants or caulking materials used for openings between structurally separate sections of wall and floors, the following products are acceptable:
 1. Hilti CP 672 Firestop Spray
 2. Hilti CP 601s Elastomeric Firestop Sealant
 3. Hilti CP 606 Flexible Firestop Sealant
 4. Hilti CP 604 Self-Leveling Firestop Sealant
 5. 3M Fire Barrier CP 25 WB

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.

- C. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- C. Install labeling required by code.

3.04 FIELD QUALITY CONTROL

- A. A Special Inspection and Testing Agency (SITA) will perform field quality control tests and inspections, as specified in Sections 01 4516 and 01 4533.
- B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.05 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

- A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

**SECTION 07 9200
JOINT SEALANTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Self-leveling pourable joint sealants.
- B. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 01 4000 – Quality Requirements
- B. Section 03 3000 – Cast-In-Place Concrete
- C. Section 04 2000 – Unit Masonry
- D. Section 07 6200 – Sheet Metal Flashing and Trim

1.03 REFERENCE STANDARDS

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015 (Reapproved 2022).
- B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2022.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
- E. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2022.
- F. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2018.
- G. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2019 (Reapproved 2020).
- H. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).
- I. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 4. Substrates the product should not be used on.
 - 5. Substrates for which use of primer is required.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- E. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.

- F. Executed warranty.
- G. Submit Material Safety Data Sheets under provisions of Section 01 7800 – Closeout Submittals for the following items:
 - 1. All mastics, glues, and adhesives
 - 2. Sealant (interior use only)

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten (10) years experience.
- B. Installer Qualifications: Company specializing in performing the work of this section and with at least five (5) years of experience.
- C. Field Adhesion Tests of Joints: Test for adhesion using most appropriate method in accordance with ASTM C1521, or another applicable method as recommended by manufacturer.
 - 1. All joint sealants shall be field tested for proper adhesion to the joint substrates prior to installation. Do not proceed with the work until job site tests have been approved by the Architect.
 - 2. Locate and provide test joints for each type of joint sealant, and substrate as directed by the Architect.
 - 3. Acceptable test joints will be used as the standard for all joint sealant work on the project.
 - a. Sealants which fail to adhere to the substrates shall be removed and replaced at no extra cost to the Owner.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Installer's Warranty: Correct defective work within a five (5) year period after Date of Substantial Completion.
- C. Manufacturer Warranty:
 - 1. Silicone Exterior Joint Sealants: Twenty (20) years.
 - 2. Polyurethane Exterior Joint Sealants: Minimum five (5) years.
 - 3. All warranties shall include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Nonsag Sealants:
 - 1. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
 - 2. Hilti, Inc: www.us.hilti.com/#sle.
 - 3. Master Builders Solutions: www.master-builders-solutions.com
 - 4. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com/#sle.
 - 5. Pecora Corporation: www.pecora.com/#sle.
 - 6. Sika Corporation: www.usa-sika.com/#sle.
 - 7. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
 - 8. Substitutions: See Section 01 6000 - Product Requirements.
- B. Self-Leveling Sealants:
 - 1. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
 - 2. Master Builders Solutions: www.master-builders-solutions.com
 - 3. Pecora Corporation: www.pecora.com/#sle.

4. Sika Corporation: www.usa-sika.com/#sle.
5. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

A. Scope:

1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to:
 - a. Wall expansion and control joints.
 - b. Joints between door, window, and other frames and adjacent construction.
 - c. Joints between different exposed materials.
 - d. Openings below ledge angles in masonry.
 - e. Other joints indicated below.
2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
 - a. Joints between door, window, and other frames and adjacent construction.
 - b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
 - 1) Exception: Such gaps and openings in gypsum board and plaster finished stud walls and suspended ceilings.
 - 2) Exception: Through-penetrations in sound-rated assemblies that are also fire-rated.
 - c. Other joints indicated below.
3. Do not seal the following types of joints:
 - a. Intentional weep holes in masonry.
 - b. Joints indicated to be treated with manufactured expansion joint cover, or some other type of sealing device.
 - c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
 - d. Joints where installation of sealant is specified in another section.
 - e. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joint Sealant Schedule:

1. Joint Type EJS-1: Vertical joints in exterior walls: Silicone, non-sag, non-staining sealant, minimum of Class 50, unless otherwise indicated.
2. Joint Type EJS-2: Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.
3. Joint Type EJS-3: Lap Joints between Manufactured Metal Panels: Butyl rubber, non-curing.
4. Joint Type EJS-4: Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.

C. Interior Joint Sealant Schedule: Use non-sag polyurethane sealant, unless otherwise indicated. Interior sealants shall be tamper resistant.

1. Joint Type IJS-1: Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
2. Joint Type IJS-2: Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.
3. Joint Type IJS-3: Floor Joints in Wet Areas: Non-sag polyurethane " -traffic-grade" sealant suitable for continuous liquid immersion.
4. Joint Type IJS-4: Wall, Ceiling, and Floor Joints Where Tamper-Resistance is Required: Non-sag tamper-resistant polyurethane sealant.

5. Joint Type IJS-5: Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
 6. Joint Type IJS-6: In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
 7. Joint Type IJS-7: Narrow Control Joints in Interior Concrete Slabs: Self-leveling polyurethane sealant.
 8. Joint Type IJS-8: Other Floor Joints: Self-leveling polyurethane "traffic-grade" sealant.
- D. Interior Wet Areas: Bathrooms, restrooms, kitchens, food service areas, and food processing areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.
- E. Sound-Rated Assemblies: Walls and ceilings identified as STC-rated, sound-rated, or acoustical.
- F. Areas Where Tamper-Resistance is Required: As indicated on drawings.

2.03 SELF-LEVELING JOINT SEALANTS

- A. Type IJS-7 - Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .
1. Movement Capability: Plus and minus 25 percent, minimum.
 2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
 3. Color: Gray.
 4. Service Temperature Range: Minus 40 to 180 degrees F.
- B. Type IJS-8 at horizontal expansion joint locations - Self-Leveling Polyurethane Sealant for Horizontal Expansion Joints: ASTM C920, Grade P, Uses T, M and O; multi-component; explicitly approved by manufacturer for horizontal expansion joints.
1. Movement Capability: Plus and minus 25 percent, minimum.
 2. Hardness Range: 30 to 35, Shore A, when tested in accordance with ASTM C661.
 3. Color: Limestone.
 4. Tensile Strength: 200 to 250 psi in accordance with ASTM D412.
- C. Type EJS-4, IJS-8 - Self-Leveling Polyurethane Sealant for Continuous Water Immersion: Polyurethane; ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure and continuous water immersion.
1. Movement Capability: Plus and minus 25 percent, minimum.
 2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
 3. Color: Gray.
 4. Service Temperature Range: Minus 40 to 180 degrees F.
- D. Type IJS-6 - High Quality Latex-Based Sound Sealant: ASTM C834, Type OP an opaque sealant, and Grade 0 Degrees C (32 Degrees F) meets requirements for low-temperature flexibility.
1. Color: White.
- E. Type EJS-4 locations as applicable - Semi-Self-Leveling Polyurethane Sealant: Intended for expansion joints in sidewalks, swimming pool decks, plazas, floors and other horizontal surfaces with up to 6 percent slope.
1. Composition: Single or multicomponent.
 2. Durometer Hardness, Type A: 35 to 45, minimum, when tested in accordance with ASTM D2240.
 3. Color: Match adjacent finished surfaces.

2.04 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.

1. Horizontal: ASTM C1330; Type C - Closed Cell Polyethylene.
 2. Vertical: ASTM C1330; Type B - Bi-Cellular Polyethylene.
 3. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
 - C. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
 - D. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.
 - E. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.
 - F. Flexible Polyurethane Foam: Single-component, gun grade, and low-expanding.
 1. Color: White.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
- E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in an inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

- A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Provide joint sealant installations complying with ASTM C1193.
- C. Install acoustical sealant application work in accordance with ASTM C919.
- D. Measure joint dimensions and size joint backers to achieve the following, unless otherwise indicated:
 1. Width/depth ratio of 2:1.
 2. Neck dimension no greater than 1/3 of the joint width.
 3. Surface bond area on each side not less than 75 percent of joint width.
- E. Install bond breaker backing tape where backer rod cannot be used.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

- I. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

END OF SECTION

**SECTION 07 9513
EXPANSION JOINT COVER ASSEMBLIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Expansion joint cover assemblies for floor, wall, ceiling, and soffit surfaces.

1.02 RELATED REQUIREMENTS

- A. Section 03 1000 - Concrete Forming and Accessories: Placement of joint cover assembly frames in formwork.
- B. Section 04 2000 - Unit Masonry: Placement of joint cover assembly frames in masonry.

1.03 REFERENCE STANDARDS

- A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- C. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles; 2010.
- D. ITS (DIR) - Directory of Listed Products; current edition.
- E. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Installation Templates: For frames and anchors to be embedded in concrete or masonry, furnish templates to relevant installers; include installation instructions and tolerances.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices and available colors and finish.
- C. Shop Drawings: Indicate joint and splice locations, miters, layout of the work, effected adjacent construction and anchorage locations.
- D. Samples: Submit two samples six inch long, illustrating profile, dimension, color, and finish selected of each specified product.
- E. Manufacturer's Installation Instructions: Indicate rough-in sizes and required tolerances for item placement.
- F. Submit Material Safety Data Sheets under provisions of Section 01 7800 – Closeout Submittals for the following items:
 - 1. All mastics, glues, and adhesives
 - 2. Thermal insulation (excluding fiberglass, foam, rubber)
 - 3. Fireproofing
 - 4. Sealant (interior use only)
- G. Certificates - Material test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of fire-rated expansion joint assemblies with requirements indicated.

1.06 QUALITY ASSURANCE

- A. Materials and work shall conform to the latest edition of reference specifications specified here-in and to all applicable codes and requirements of local authorities having jurisdiction.

- B. Fire Performance Characteristics - Where indicated, provide expansion joint cover assemblies identical to those of assemblies whose fire resistance has been determined per ANSI/UL 263, NFPA 251, U.B.C. 43-1, or rated period by Underwriters Laboratories, Inc.
 - 1. Fire Rating - Not less than the rating of adjacent construction.
- C. Loading Characteristics - Standard floor covers should be designed to withstand a maximum point load of 500 lbs. without damage or permanent deformation. Heavy-duty covers should withstand a point load of 2,000 lbs.
- D. Single-Source Responsibility - Obtain expansion joint cover assemblies from one source from a single manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Expansion Joint Cover Assemblies:
 - 1. Balco; a CSW Industrials Company: www.balcousa.com
 - 2. Construction Specialties, Inc: www.c-sgroup.com.
 - 3. EMSEAL Joint Systems, Ltd: www.emseal.com/#sle.
 - 4. Inpro: www.inprocorp.com/#sle.
 - 5. MM Systems Corp: www.mmsystemscorp.com.
 - 6. Nystrom, Inc: www.nystrom.com.
 - 7. Watson Bowman Acme Corp.: www.watsonbowmanacme.com.
 - 8. Substitutions: See Section 01 6000 - Product Requirements.

2.02 EXPANSION JOINT COVER ASSEMBLY APPLICATIONS

- A. Floor Joints at all types of Floor Finish :
 - 1. C-S Group; Model GFT-100 X 2 Floor to Floor Transition
 - 2. C-S Group; Model GFTW-100 X 2 Floor to Wall Transition
 - 3. C-S Group; Model PC-100 Floor to Floor Plate Cover
- B. Floor Joints at all types of Floor Finish at existing concrete floor slab locations:
 - 1. C-S Group; Model GFPS-100 Floor to Floor Transition
 - 2. C-S Group; Model GFPSW-100 Floor to Wall Transition
- C. Wall Joints at all types of Walls, Surface Mounted:
 - 1. C-S Group; Model ASM-100 Flat
 - 2. C-S Group; Model ASMC-100 Corner Transition
- D. Ceiling Joints at Suspended Acoustic Ceiling Finish:
 - 1. C-S group; Model HC-100 Flat
 - 2. C-S Group; Model HCW-100 Wall to Ceiling Transition
- E. Ceiling Joints at Gypsum Board Ceiling Finish:
 - 1. C-S Group; Model FWF-100 Flat
 - 2. C-S Group; Model FWFC-100 Wall to Ceiling Transition
- F. Interior/Exterior Fire-Rated Wall Joints Subject to Thermal Movement:
 - 1. Manufacturers:
 - a. EMSEAL Joint Systems, Ltd; Emshield WFR2 System: www.emseal.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- G. Parking/Bridge Deck Joints:
 - 1. Manufacturers:
 - a. EMSEAL Joint Systems, Ltd; Emshield DFR2 system: www.emseal.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 EXPANSION JOINT COVER ASSEMBLIES

- A. Expansion Joint Cover Assemblies - General: Factory-fabricated and assembled; designed to completely fill joint openings, sealed to prevent passage of air, dust, water, smoke; suitable for traffic expected.
 - 1. Joint Dimensions and Configurations: As indicated on drawings.
 - 2. Joint Cover Sizes: Selected to suit joint width and configuration, based on manufacturer's published recommendations and limitations.
 - 3. Lengths: Provide covers in full lengths required; avoid splicing wherever possible.
 - 4. Anchors, Fasteners, and Fittings: Provided by cover manufacturer.
- B. Floor Joint Covers: Coordinate with indicated floor coverings.
 - 1. If floor covering is not indicated, obtain instructions from Architect before proceeding.
 - 2. If style is not indicated, provide extruded aluminum frame both sides, resilient seals, and minimize exposed metal.
- C. Resilient Seal Type Covers: Having flat exposed surface without crevices that could collect dirt; designed to withstand expected movement without extrusion of seal from joint assembly; for floors, provide style that is flush with top of floor covering; for exterior joints, weathertight.
- D. Sliding Cover Plate Type Covers: Provide plate with beveled edges and neat fit that does not collect dirt.
- E. Covers In Gypsum Board Assemblies: Provide style with anchoring wings that can be completely covered by joint compound.
- F. Covers In Fire Rated Assemblies: Provide cover assembly having fire rating equivalent to that of assembly into which it is installed.
 - 1. Acceptable Evaluation Agencies: UL (DIR) and ITS (DIR).

2.04 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper; or ASTM B308/B308M, 6061 alloy, T6 temper.
 - 1. Exposed Finish Outdoors: Natural anodized.
 - 2. Exposed Finish at Floors: Mill finish or natural anodized.
 - 3. Exposed Finish at Walls and Ceilings: Natural anodized.
- B. Resilient Seals:
 - 1. For Ceilings: Any resilient material, flush, pleated, or hollow gasket.
 - 2. Color: Floor: Gray Ceilings: White.
- C. All joints specified for 1" wide. Wider joints, if indicated on the drawings, shall be same model series.
- D. Anchors and Fasteners: As recommended by cover manufacturer.
- E. Ferrous Metal Anchors: Galvanized where embedded in concrete or in contact with cementitious materials.
- F. Threaded Fasteners: Aluminum.
- G. Backing Paint for Aluminum Components in Contact with Cementitious Materials: Asphaltic type.
- H. Provide manufacturers associated fire barrier at fire rated walls and floors.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine the area and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

- B. Verify that joint preparation and dimensions are acceptable and in accordance with manufacturer's requirements.
- C. Verify that frames and anchors installed by others are in correct locations and suitable for installation of remainder of assembly.

3.02 PREPARATION

- A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.03 INSTALLATION

- A. Install components and accessories in accordance with manufacturer's instructions.
- B. Align work plumb and level, flush with adjacent surfaces.
- C. Rigidly anchor to substrate to prevent misalignment.

3.04 PROTECTION

- A. Do not permit traffic over unprotected floor joint surfaces.
- B. Provide strippable coating to protect finish surface.

END OF SECTION

**SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for wood doors.
- C. Fire-rated hollow metal doors and frames.
- D. Thermally insulated hollow metal doors with frames.
- E. Hollow metal borrowed lites glazing frames.
- F. Accessories, including glazing, louvers, matching panels, and removable stops and astragals.

1.02 RELATED REQUIREMENTS

- A. Section 08 7100 - Door Hardware.
- B. Section 08 8000 - Glazing: Glass for doors and borrowed lites.
- C. Section 09 9000 - Painting and Coating: Field painting.

1.03 REFERENCE STANDARDS

- A. 2012 TAS - Texas Accessibility Standards; 2012.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2017.
- D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2021.
- G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.
- H. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2016.
- I. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- J. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.
- K. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.
- L. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2007.
- M. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.
- N. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2019.
- O. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.
- P. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
- E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.
- F. Submit Material Safety Data Sheets under provisions of Section 01 7800 – Closeout Submittals for the following items:
 - 1. All mastics, glues, and adhesives
 - 2. Thermal insulation (excluding fiberglass, foam, rubber)
 - 3. Sealant (interior use only)
 - 4. Fire doors (insulating material)

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- B. Maintain at project site copies of reference standards relating to installation of products specified.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hollow Metal Doors and Frames:
 - 1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 2. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 3. Deansteel Manufacturing, Inc.: www.deansteel.com.
 - 4. Fleming Door Products, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 5. Mesker, dormakaba Group: www.meskeropeningsgroup.com/#sle.
 - 6. Pearland Industries, Inc.: www.pearlandindustries.com
 - 7. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
 - 8. Rocky Mountain Metals, Inc.: www.rockymountainmetals.com.
 - 9. Steelcraft, an Allegion brand: www.allegion.com/sle.
 - 10. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
 - 1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
 - 2. Accessibility: Comply with ICC A117.1, 2012 TAS and ADA Standards.

3. Typical Door Face Sheets: Flush.
4. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
5. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
6. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
 - a. Based on NAAMM HMMA Custom Guidelines: Provide at least A25/ZF75 (galvannealed) for interior applications, and at least A60/ZF180 (galvannealed) or G60/Z180 (galvanized) for corrosive locations.
- B. Hollow Metal Panels: Same construction, performance, and finish as doors.
- C. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.
- D. Doors at interior locations shall be manufactured of cold rolled, or annealed steel. Doors must be of continuously welded, seamless construction with all angles, molds, returns and miters neatly welded and all weld beads ground smooth for finishing.
- E. Doors at exterior locations shall be manufactured of A60 galvannealed or G60 hot dipped galvanized steel. Doors must be of continuously welded, seamless construction with all angles, molds, returns, and miters neatly welded and all weld beads ground smooth for finishing. All exterior doors shall seal tightly and not allow insect pests easy access to the buildings.
- F. Face sheets of 16 gauge steel reinforced and sound-deadened by 22 gauge formed steel vertical stiffeners spaced not less than 6" o.c. and attached to face sheets by spot welds not less than 5" o.c. Vertical stiffeners at exterior door locations shall be galvannealed or hot dip galvanized. Voids between vertical stiffeners shall be filled with fiberglass batting.
- G. Top and bottom edges closed with continuous recessed steel channels, of not less than 16 gauge, spot welded to both faces. Top edge of exterior doors sealed flush with welded in place closing channel to exclude water.
- H. Overlapping steel astragals for pairs of labeled doors as required by manufacturer to meet codes.
- I. Doors and frames are to be prepared to receive mortise type hardware and at hinge, lock, latch, and all other hardware locations, reinforcing plates shall be spot welded to the inner surface of the jambs. Hinge reinforcements shall not be less than 7 gauge steel. All top hinge reinforcements to incorporate manufacturer's optional high frequency hinge reinforcement or full jamb depth hinge reinforcement. All other hardware reinforcements shall be not less than 12 gauge steel. Where door closers or brackets are to be installed, reinforcing plates shall be not less than 12 gauge steel. Twenty-four gauge galvanized steel plaster guards are to be spot welded over the hardware reinforcing plates. Provide 12 gauge reinforcement, for full height of door leaf, welded inside throat of frame to door rabbet wherever continuous geared hinges are scheduled. Provide 1/2" polystyrene, Celotex, or similar material, adhesive attached to the continuous hinge reinforcement inside the throat of the frame wherever continuous geared hinges are scheduled. Necessary holes for field installation of mortise type hardware shall be drilled and tapped from templates, which are to be furnished to the frame manufacturer by the hardware contractor. Provide suitable reinforcements for surface applied hardware, but no drilling or tapping is to be done at the factory for application of surface applied hardware. Prepare frames for silencers.

- J. All glazing trim shall either be an integral part of the door face on the secure side with a removable bead flush with the opposite door face or metal glass light trim with a projection not to exceed 3/32" from either door face,

2.03 FULL AND TWO-LIGHT DOORS

- A. Doors at interior locations shall be manufactured of cold rolled, or annealed steel. Doors must be of welded, seamless tubular stile and rail construction with all angles, tube intersections, molds, returns and miters neatly welded and all weld beads ground smooth for finishing. Visible seams on door faces are not acceptable.
- B. Doors at exterior locations shall be manufactured of A60 galvanized or G60 hot dipped galvanized steel. Doors must be of welded, seamless tubular stile and rail construction with all angles, tube intersections, molds, returns and miters neatly welded and all weld beads ground smooth for finishing. Visible seams on door faces are not acceptable.
- C. Face sheets of 16 gauge steel. Voids in tubular members shall be filled with fiberglass batting.
- D. Vertical stiles, top rail, and intermediate rail (if detailed) shall be of 6" nominal construction. Tubular construction of top rail shall provide a flush top surface to exclude water and moisture. Bottom rail shall be of 12" nominal construction.

2.04 HOLLOW METAL DOORS

- A. Exterior Doors: Thermally insulated.
 - 1. Core Material: Manufacturers standard core material/construction and in compliance with requirements.
 - 2. Door Thermal Resistance: R-Value of 6 minimum.
 - 3. Door Thickness: 1-3/4 inch, nominal.
 - 4. Top Closures: Flush with top of faces and edges.
 - 5. Weatherstripping: Refer to Section 08 7100.
- B. Interior Doors, Non-Fire Rated:
 - 1. Door Core Material: Vertical steel stiffeners.
 - 2. Door Thickness: 1-3/4 inch, nominal.
- C. Fire-Rated Doors:
 - 1. Fire Rating: As indicated on drawings, tested in accordance with UL 10C ("positive pressure").
 - a. Temperature-Rise Rating (TRR) Across Door Thickness: In accordance with local building code and authorities having jurisdiction.
 - b. Provide units listed and labeled by UL (Underwriters Laboratories) - UL (BMD).
 - c. Attach fire rating label to each fire rated unit.
 - 2. Core Material: Vertical steel stiffeners.
 - 3. Door Thickness: 1-3/4 inch, nominal.

2.05 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Exterior Door Frames: Full profile/continuously welded type.
 - 1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvanized) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
 - 2. Frame Metal Thickness: 14 gage, 0.067 inch, minimum.
 - 3. All angles, molds, returns and miters neatly welded and all weld beads ground smooth for finishing.
 - 4. Weatherstripping: Separate, see Section 08 7100.
- C. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
 - 1. Frame Metal Thickness: 14 gage, 0.067 inch or 16 gage, 0.053 inch, minimum.

2. Three-sided frames for single doors up to and including 4'-0" in width shall be manufactured of 16 gauge steel. Frames for pairs of doors 6'-0" and over, all sidelight frames, and all borrowed light frames shall be manufactured of 14 gauge steel. All angles, molds, returns and miters neatly welded and all weld beads ground smooth for finishing.
- D. Door Frames, Fire-Rated: Full profile/continuously welded type.
 1. Fire Rating: Same as door, labeled.
 2. Frame Metal Thickness: 14 gage, 0.067 inch or 16 gage, 0.053 inch, minimum.
 3. Three-sided frames for single doors up to and including 4'-0" in width shall be manufactured of 16 gauge steel. Frames for pairs of doors 6'-0" and over, all sidelight frames, and all borrowed light frames shall be manufactured of 14 gauge steel. All angles, molds, returns and miters neatly welded and all weld beads ground smooth for finishing.
 - E. Mullions for Pairs of Doors: Fixed, except where removable is indicated, with profile similar to jambs.
 1. All two-piece mullions shall be factory welded to form a single-piece, inseparable section before assembly into a frame unit.
 - F. Transom Bars: Fixed, of profile same as jamb and head.

2.06 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.07 ACCESSORIES

- A. Louvers: Roll formed steel with concealed frame; finish same as door components ; factory-installed.
 1. Style: Standard straight slat blade.
 2. Fasteners: Exposed tamper proof fasteners.
- B. Glazing: As specified in Section 08 8000.
- C. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered corners; prepared for countersink style tamper proof screws.
- D. Astragals for Double Doors: Specified in Section 08 7100.
- E. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.
- F. Grout for Frames: Portland cement grout with maximum 4 inch slump for hand troweling; thinner pumpable grout is prohibited.
- G. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions. Omit silencers on exterior doors.
- H. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.
- I. For each jamb in masonry construction, provide 3 or more 16 gauge adjustable jamb anchors of the T-anchor type or of the wire masonry anchor type spaced not more than 30" apart.
- J. For each jamb in steel stud construction, provide 3 or more 18 gauge drywall type jamb anchors.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

- D. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.
- E. Verify exterior substrates and weather barriers have been completed to ensure proper air/water tight transition is maintained.

3.02 PREPARATION

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Install fire rated units in accordance with NFPA 80.
- C. Where practicable, place frames prior to construction of enclosing walls and ceilings.
- D. Set frames accurately into position, plumbed, aligned, and braced securely until permanent anchors are set.
- E. Coordinate frame anchor placement with wall construction.
- F. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- G. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
- H. At in-place construction, set frames and secure to adjacent construction with machine screws and suitable anchorage devices. Provide "Z" fillers at each screw location.
- I. Fit and hang doors to maintain specified clearances. Metal hinge shims are acceptable to maintain clearances.
- J. Install door hardware as specified in Section 08 7100.
- K. Comply with glazing installation requirements of Section 08 8000.
- L. Coordinate installation of electrical connections to electrical hardware items.
- M. Immediately after erection, sand smooth all rusted and damaged areas of prime coat, and apply touch-up of compatible air-drying primer.
- N. Touch up damaged factory finishes.

3.04 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

- A. Adjust for smooth and balanced door movement.
- B. Adjust sound control doors so that seals are fully engaged when door is closed.
- C. Test sound control doors for force to close, latch, and unlatch; adjust as necessary in compliance with requirements.

END OF SECTION

**SECTION 08 1416
FLUSH WOOD DOORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flush wood doors; flush and flush glazed configuration; fire-rated, non-rated, and acoustical.
- B. High pressure decorative laminate facing

1.02 RELATED REQUIREMENTS

- A. Section 01 6210 - Schedule of Materials and Colors
- B. Section 08 1113 - Hollow Metal Doors and Frames.
- C. Section 08 8000 - Glazing.

1.03 REFERENCE STANDARDS

- A. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
- B. ASTM E413 - Classification for Rating Sound Insulation; 2016.
- C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- D. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. ITS (DIR) - Directory of Listed Products; current edition.
- F. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- G. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2019.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
- D. Samples: Submit two samples of door veneer, 6 by 6 inches in size illustrating wood grain, stain color, and sheen.
- E. Test Reports: Show compliance with specified requirements for the following:
 - 1. Sound-retardant doors and frames; sealed panel tests are not acceptable.
- F. Samples: Submit three samples of door veneer, 6 by 6 inch in size illustrating plastic laminate pattern and color.
- G. Manufacturer's Installation Instructions: Indicate special installation instructions.
- H. Specimen warranty.
- I. Warranty, executed in Owner's name.
- J. Closeout Submittals
 - 1. Submit under provisions of Section 01 7800 – Closeout Submittals.
 - 2. Submit Material Safety Data Sheets under provisions of Section 01 7800 – Closeout Submittals for the following items:
 - a. All mastics, glues, and adhesives
 - b. Sealant (interior use only)
 - c. Fire doors (insulating material)

1.05 QUALITY ASSURANCE

- A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than five years of documented experience.
 - 1. Company with at least one project within past five years with value of woodwork within at least 20 percent of cost of woodwork for this project.
- C. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.
- D. Certifications
 - 1. Fire Ratings Compliance: Fire-rated wood doors to comply with NFPA-80, Positive Pressure Testing UBC 7-2-97 and/or UL10C, and requirements according to building code standards having local jurisdiction.
 - 2. Label Certification: All doors requiring fire-rating shall carry either UL or ITS (Warnock Hersey) metal label stating:
 - a. Name and Logo of Listing Agency
 - b. Name of Door Manufacturer
 - c. Compliance with UBC 7-2-97 and/or UL10C
 - d. Temperature rise rating
 - e. Compliance with "S" label and/or UL 1784 requirements at all 20-minute rated doors and elsewhere as required by the building code and/or the AHJ
 - f. Hourly rating

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Store doors flat and off the floor on a level surface in a dry, well-ventilated building. Do not store on edge. Protect doors from dirt, water and abuse.
- C. Accept doors on site in manufacturer's packaging, and inspect for damage.
- D. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.
- E. Do not subject interior doors to extremes in either heat or humidity. HVAC systems should be operational and balanced, providing a temperature range of 50 to 90 degrees Fahrenheit and 30% to 50% relative humidity.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, telegraphing core construction, and repair or replacement of the door as originally furnished.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. High Pressure Decorative Laminate (HPDL) Faced Doors:
 - 1. AJW Architectural Products: www.ajw.com/#sle.
 - 2. Oregon Door: www.oregondoor.com/#sle.
 - 3. Masonite Architectural: www.architectural.masonite.com/#sle.
 - 4. Poncraft Door Co: www.poncraft.com/#sle.
 - 5. VT Industries, Inc: www.vtindustries.com/#sle.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOORS AND PANELS

- A. Doors: See drawings for locations and additional requirements.
 - 1. Quality Standard: Premium Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.
 - 2. High Pressure Decorative Laminate (HPDL) Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
 - 1. Provide solid core doors at each location.
 - 2. Fire Rated Doors: Tested to ratings as indicated on drawings in accordance with ICC (IBC) - Positive Pressure; Underwriters Laboratories Inc. (UL) labeled.
 - 3. Sound Retardant Doors: Minimum STC of 45, calculated in accordance with ASTM E413, tested in accordance with ASTM E90.
 - 4. High pressure decorative laminate (HPDL) finish as indicated on drawings.

2.03 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type structural composite lumber core (SCLC), plies and faces as indicated.
- B. Fire-Rated Doors: Mineral core type, or fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.
- C. Sound-Rated Doors: Equivalent to type, with particleboard core (PC) construction as required to achieve STC rating specified; plies and faces as indicated above.

2.04 DOOR FACINGS

- A. High Pressure Decorative Laminate (HPDL) Facing for Fire Doors: NEMA LD 3, SGF; color as selected; See Section 01 6210, Schedule of Materials and Colors.
- B. High Pressure Decorative Laminate (HPDL) Facing for Non-Fire-Rated Doors: NEMA LD 3, HGS; color as selected; See Section 01 6210, Schedule of Materials and Colors.
- C. Facing Adhesive: Type I - waterproof.

2.05 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
 - 1. Provide solid blocks at Lock edge, top of door for closer, and exit devices for hardware reinforcement.
 - 2. Provide solid blocking for other throughbolted hardware.
 - 3. Mineral core veneer doors should have a minimum of 1/2" stile on hinge edge of door. Veneer shall be 5 ply.
- C. Where supplementary protective edge trim is required, install trim after veneer facing has been applied full-width.
- D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- F. Cut and configure exterior door edge to receive recessed weatherstripping devices.
- G. Provide edge clearances in accordance with the quality standard specified.

2.06 ACCESSORIES

- A. Hollow Metal Door Frames: See Section 08 1113.

- B. Metal Louvers:
 - 1. Material and Finish: Roll formed steel; pre-painted finish to color as selected.
- C. Glazing: See Section 08 8000.
- D. Glazing Stops: Rolled steel channel shape, mitered corners; prepared for countersink style tamper proof screws.
- E. Astragals for Fire-Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge, specifically for double doors.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
 - 1. Install fire-rated doors in accordance with NFPA 80 and ITS (DIR) requirements.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.
- E. Coordinate installation of glazing.
- F. Install door louvers plumb and level.

3.03 TOLERANCES

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

END OF SECTION

**SECTION 08 3100
ACCESS DOORS AND PANELS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall and ceiling access door and frame units.

1.02 RELATED REQUIREMENTS

- A. Section 09 9000 - Painting and Coating: Field paint finish.

1.03 REFERENCE STANDARDS

- A. ITS (DIR) - Directory of Listed Products; current edition.
- B. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Shop Drawings: Indicate exact position of each access door and/or panel unit.
- D. Manufacturer's Installation Instructions: Indicate installation requirements, rough-in dimensions, and operation features.
- E. Project Record Documents: Record actual locations of each access unit.
- F. Closeout Submittals
 - 1. Submit under provisions of Section 01 7800 – Closeout Submittals.
 - 2. Submit Material Safety Data Sheets under provisions of Section 01 7800 – Closeout Submittals for the following items:
 - a. All mastics, glues and adhesives
 - b. Sealant (interior use only)
 - c. Fire doors (insulating material)

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years experience.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

- A. Wall-Mounted Units:
 - 1. Material: Steel.
 - 2. Size: 24 by 24 inch, unless otherwise indicated.
 - a. 10 x 10 inches at single valve access and at all roof drain locations on first floor.
 - 3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
 - 4. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.
 - 5. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
 - 6. Plaster Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
 - 7. Masonry Mounting Criteria: Provide surface-mounted frame with door surface flush with frame surface.

- B. Wall-Mounted Units in Wet Areas:
 - 1. Material: Stainless steel.
 - 2. Size: 24 by 24 inch, unless otherwise indicated.
 - 3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
 - 4. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.
 - 5. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
 - 6. Plaster Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
 - 7. Masonry Mounting Criteria: Provide surface-mounted frame with door surface flush with frame surface.
- C. Fire-Rated Wall-Mounted Units:
 - 1. Wall Fire-Rating: As indicated on drawings.
 - 2. Material: Steel.
 - 3. Size: 24 by 24 inch, unless otherwise indicated.
 - 4. Door/Panel: Insulated double-surface panel, with tool-operated spring or cam lock and no handle.
- D. Ceiling-Mounted Units:
 - 1. Material: Steel.
 - 2. Size in Other Ceilings: 24 by 24 inch, unless otherwise indicated.
 - 3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
- E. Fire-Rated Ceiling-Mounted Units:
 - 1. Ceiling Fire-Rating: As indicated on drawings.
 - 2. Material: Steel.
 - 3. Size: 24 by 24 inch, unless otherwise indicated.
 - 4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings are correctly sized and located.
- B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to proceeding with this work.
- B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.03 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

**SECTION 08 3323
OVERHEAD COILING DOORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Insulated coiling doors.
- B. Electric operators and control stations.
- C. Wiring from electric circuit disconnect to operators and control stations.

1.02 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.
- B. Division 26 - Electrical

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- C. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. ITS (DIR) - Directory of Listed Products; current edition.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
- F. NEMA MG 1 - Motors and Generators; 2018.
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL (DIR) - Online Certifications Directory; Current Edition.
- I. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide general construction, electrical equipment, and component connections and details.
- C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.
- D. Samples: Submit two slats, 3 by 6 inches in size illustrating shape, color and finish texture.
- E. Manufacturer's Installation Instructions: Indicate installation sequence and procedures, adjustment and alignment procedures.
- F. Manufacturer's qualification statement.
- G. Installer's qualification statement.
- H. Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years documented experience and approved by manufacturer.

- C. Products Requiring Electrical Connection: Listed and classified by ITS (DIR), UL (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for purpose specified.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Submit a written warranty, executed by the Contractor, Installer, and Manufacturer, agreeing to repair or replace doors that fail in materials or workmanship within the specified warranty period.
 - 1. Warranty Period: One (1) year after date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Overhead Coiling Doors:
 - 1. C.H.I. Overhead Doors: www.chiohd.com/#sle.
 - 2. Clopay Building Products: www.clopaydoor.com/#sle.
 - 3. Cornell Iron Works, Inc: www.cornelliron.com/#sle.
 - 4. Raynor Garage Doors: www.raynor.com/#sle.
 - 5. The Cookson Company: www.cooksondoor.com/#sle.
 - 6. Wayne-Dalton, a Division of Overhead Door Corporation: www.wayne-dalton.com/#sle.
 - 7. Substitutions: See Section 01 6000 - Product Requirements.

2.02 COILING DOORS

- A. Exterior Opening Coiling Doors: Steel slat curtain.
 - 1. Capable of withstanding positive and negative design wind loads of 20 psf, without undue deflection or damage to components.
 - 2. Sandwich slat construction with insulated core of foamed-in-place polyurethane insulation; minimum R-value of 8.0.
 - 3. Air Infiltration – Maximum air leakage of 1.00 cfm/ft² in accordance with the ICC (IECC) International Energy Conservation Code.
 - 4. Nominal Slat Size: 3 inches wide by required length.
 - 5. Finish: Factory powder coated, color as selected. See Section 01 6210-Schedule of Materials and Colors.
 - 6. Guide, Angles: Powder coated to match curtain.
 - 7. Hood Enclosure: Manufacturer's standard; Powder coated to match curtain.
 - a. Provide mechanism cover for all exposed moving operator components.
 - 8. Electric operation.
 - 9. Mounting: Surface mounted.

2.03 MATERIALS AND COMPONENTS

- A. Metal Curtain Construction: Interlocking slats.
 - 1. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
 - 2. Curtain Bottom for Slat Curtains: Fitted with angles or aluminum extrusions to provide reinforcement and positive contact in closed position.
 - 3. Weatherstripping for Exterior Doors: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and lintel brush seal where curtain enters hood enclosure of exterior doors.
 - 4. Steel Slats: Minimum thickness, 22 gauge, 0.03 inch; ASTM A653/A653M galvanized steel sheet. Provide 20 gauge slats where opening size dictates.
 - a. Galvanizing: Minimum G60 coating.
 - B. Guides - Angle: ASTM A36/A36M metal angles, size as required for door configuration.
 - C. Hood Enclosure and Trim: Internally reinforced to maintain rigidity and shape.
-

1. Minimum thickness; 24 gauge, 0.024 inch.
 2. Powder coated to match curtain.
 3. Provide mechanism cover for all exposed moving operator components.
- D. Lock Hardware:
1. For motor operated units, additional lock or latching mechanisms are not required.
- E. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb nominal force to operate.

2.04 ELECTRIC OPERATION

- A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
1. Provide tamperproof operation cycle counter.
- B. Electric Operators:
1. Mounting: Front of Coil.
 2. Motor Enclosure:
 - a. Interior Coil: NEMA MG 1, Type 1; totally enclosed fan cooled (TEFC).
 3. Motor Rating: Minimum 1/3 HP; industrial duty, or as required by the manufacturer.
 4. Motor Voltage: 120 volts, single phase, 60 Hz. minimum. Verify with electrical drawings.
 5. Controller Enclosure: NEMA 250, Type 1.
 6. Opening Speed: 8-9 inches per second.
 7. Brake: Manufacturer's standard type, activated by motor controller.
 8. Manual override in case of power failure.
 9. See Division 26 - Electrical for electrical connections.
- C. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated; enclose terminal lugs in terminal box sized to comply with NFPA 70.
- D. Control Station: Provide standard "Open/Close" key-operated, 'Open-Close-Stop' momentary-contact control device with small format Best type 7-pin cylinder, NEMA 1B for each operator complying with UL 325.
1. 24 volt circuit.
 2. Surface mounted, at interior door jamb at CMU walls.
 3. Recess mounted, at interior door jamb at gypsum walls.
 4. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
 - a. Primary Device: Provide monitored sensing edge with wireless edge connection to motor control circuit for momentary contact open/close control.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that opening sizes, tolerances and conditions are acceptable.

3.02 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- E. Coordinate installation of electrical service with Division 26 Electrical.

- F. Complete wiring from disconnect to unit components.
- G. Install enclosure and perimeter trim.

3.03 TOLERANCES

- A. Maintain dimensional tolerances and alignment with adjacent work.
- B. Maximum Variation From Plumb: 1/16 inch.
- C. Maximum Variation From Level: 1/16 inch.
- D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 feet straight edge.

3.04 ADJUSTING

- A. Adjust operating assemblies for smooth and noiseless operation.

3.05 CLEANING

- A. Clean installed components.
- B. Remove labels and visible markings.

END OF SECTION

SECTION 08 3473
SOUND CONTROL DOOR ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sound control door assemblies.
 - 1. Metal doors and frames.
 - 2. Wood doors and metal frames.
 - 3. Fire-rated doors and frames.
 - 4. Interior doors and frames, non-fire-rated.
- B. Accessories, including glazing and matching panels.

1.02 RELATED REQUIREMENTS

- A. Section 08 7100 - Door Hardware.
- B. Section 08 8000 - Glazing: Glass for doors and borrowed lites.

1.03 ABBREVIATIONS AND ACRONYMS

- A. ANSI: American National Standards Institute.
- B. ASCE: American Society of Civil Engineers.
- C. BHMA: Builders Hardware Manufacturers Association.
- D. HMMA: Hollow Metal Manufacturers Association.
- E. NAAMM: National Association of Architectural Metal Manufacturers.
- F. NFPA: National Fire Protection Association.
- G. SDI: Steel Door Institute.
- H. UL: Underwriters Laboratories.

1.04 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames; 2007 (Reaffirmed 2011).
- C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.
- D. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2003 (R2009).
- E. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2017.
- F. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.
- G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- H. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2021.
- I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.
- J. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

- K. ASTM E413 - Classification for Rating Sound Insulation; 2016.
- L. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- M. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 4.0; 2021.
- N. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2016.
- O. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- P. ITS (DIR) - Directory of Listed Products; current edition.
- Q. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.
- R. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.
- S. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2007.
- T. NAAMM HMMA 865 - Guide Specifications for Sound Control Hollow Metal Doors and Frames; 2013.
- U. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2019.
- V. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2017.
- W. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.
- X. SDI 128 - Guidelines for Acoustical Performance of Standard Steel Doors and Frames; 2016.
- Y. UL (DIR) - Online Certifications Directory; Current Edition.
- Z. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- AA. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2013.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- D. Samples: Submit two samples of metal, showing factory finishes, colors, and surface texture.
- E. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
- F. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.
- G. Manufacturer's Qualification Statement.
- H. Installer's Qualification Statement.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
- C. Maintain at project site copies of reference standards relating to installation of products specified.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect metal doors in compliance with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) and specified requirements.
 - 1. Temporary Frame Spreaders: Provide welded frame jamb spreaders to bottom of metal frame prior to shipping.
- B. Protect wood doors in compliance with WDMA I.S. 1A and specified requirements.
- C. Remove doors and frames from resilient packaging upon delivery on site and inspect for damage, provide cover over doors for protection until installed, and store in vertical position properly braced with blocking to permit air circulation between components.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Sound Control Door Assemblies:
 - 1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 2. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 3. Industrial Acoustics Co, Inc (IAC): www.iac-acoustics.com
 - 4. Krieger Specialty Products: www.kriegerproducts.com
 - 5. Overly Door Company: www.overly.com/#sle.
 - 6. Wenger Corporation: www.wengercorp.com.
 - 7. Substitutions: See Section 01 6000 - Product Requirements.
- B. Wood Sound Control Door Assemblies:
 - 1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 2. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 3. Industrial Acoustics Co, Inc (IAC): www.iac-acoustics.com
 - 4. Krieger Specialty Products: www.kriegerproducts.com
 - 5. Overly Door Company: www.overly.com/#sle.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 REGULATORY REQUIREMENTS

- A. Accessibility: Comply with ICC A117.1 and ADA Standards.
- B. Opening Force of Sound Control Doors, Non-Fire Rated: 5 lbs, maximum, in compliance with ADA Standards.
- C. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- D. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with specified requirements for each type; for instance, a sound control door is also indicated as being an exterior door must comply with requirements specified for sound control doors and exterior doors; where two requirements conflict, comply with most stringent.

2.03 COMPONENTS

- A. Panels: Same construction, performance, and finish as doors.
- B. Metal Door Top Closures: Flush end closure channel, with top and door faces aligned.
- C. Door Edge Profile: Manufacturer's standard for application indicated.
- D. Glazed Lights: Factory installed, with removable stops on secure side; sizes and configurations as indicated on drawings.
 - 1. Style: Manufacturer's standard.

2.04 SOUND CONTROL DOORS

- A. Metal Sound Control Interior Doors: Provide fire-rated door construction as indicated.
1. Metal Doors: Refer to drawings for locations and additional requirements.
 - a. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - 1) Level 1 - Standard-duty.
 - 2) Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
 - 3) Model 1 - Full Flush.
 - 4) Comply with guidelines of SDI 128 for acoustic performance of metal doors and frames.
 - 5) Door Face Metal Thickness: 20 gauge, 0.032 inch, minimum.
 - b. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
 - 1) Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvanized) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
 - (a) Based on SDI Standards: Provide at least A40/ZF120 (galvanized) where necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvanized) for corrosive locations.
 2. Sound Transmission Class (STC) Rating of Sound Control Door Assembly: STC of 50, minimum, tested in accordance with ASTM E413, and tested in accordance with ASTM E90.
 3. Door Thickness: As required to comply with sound control requirements as indicated.
 4. Door Face Sheets: Flush.
 5. Door Finish: Factory primed and field finished.
 6. Sound Seals: As required by manufacturer to meet indicated sound control ratings.
 7. Interior Doors, Non-Fire Rated:
 - a. Door Core Material: As required by manufacturer to meet indicated sound control ratings.
 8. Fire-Rated Doors:
 - a. Fire Rating: As indicated on drawings, complying with NFPA 80 and tested in accordance with UL 10C and NFPA 252 as positive pressure fire tests.
 - b. Provide units listed and labeled by UL (DIR) or ITS (DIR).
 - 1) Attach fire rating label to each fire rated unit.
 - c. Door Core Material: As required by manufacturer to meet indicated fire and sound control ratings.
- B. Wood Sound Control Interior Doors: Provide fire-rated door construction as indicated.
1. Wood Doors: Refer to drawings for locations and additional requirements.
 - a. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless otherwise indicated.
 - b. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
 - 1) Wood veneer facing with factory transparent finish as indicated on drawings.
 - c. High Pressure Decorative Laminate (HPDL) Faced Doors: 5-ply unless otherwise indicated.
 - 1) High pressure decorative laminate (HPDL) finish as indicated on drawings.

2. Sound Transmission Class (STC) Rating of Sound Control Door Assembly: STC of 50, minimum, tested in accordance with ASTM E413, and tested in accordance with ASTM E90.
3. Door Thickness: As required to comply with sound control requirements as indicated.
4. Door Face Sheets: Flush.
5. Door Finish: Factory primed and field finished.
6. Sound Seals: As required by manufacturer to meet indicated sound control ratings.
7. Interior Doors, Non-Fire Rated:
 - a. Door Core Material: As required by manufacturer to meet indicated sound control ratings.
8. Fire-Rated Doors:
 - a. Fire Rating: As indicated on drawings, complying with NFPA 80 and tested in accordance with UL 10C and NFPA 252 as positive pressure fire tests.
 - b. Provide units listed and labeled by UL (DIR) or ITS (DIR).
 - 1) Attach fire rating label to each fire rated unit.
 - c. Door Core Material: As required by manufacturer to meet indicated fire and sound control ratings.

2.05 SOUND CONTROL DOOR FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Metal Sound Control Interior Door Frames: Face welded type.
 1. Frame Finish: Factory primed and field finished.
 2. Interior Door Frames, Non-Fire Rated:
 - a. Frame Metal Thickness: 14 gauge, 0.067 inch, minimum.
 3. Fire-Rated Door Frames:
 - a. Fire Rating: Same as door, and labeled.
 - b. Frame Metal Thickness: 14 gauge, 0.067 inch, minimum.
- C. Mullions for Pairs of Doors: Removable type, with profile similar to jambs.
- D. Transom Bars: Fixed, of profile same as jamb and head.
- E. Provide mortar guard boxes for hardware cut-outs in frames installed in masonry or being grouted.
- F. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inch high to fill opening without cutting masonry units.
- G. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

2.06 DOOR HARDWARE

- A. Astragals for Double Doors: Overlapping or meeting stile for field installation in compliance with sound control requirements.
 1. Fire-Rated Doors: Steel, and shape as required for fire rating.
- B. Hinges: Cam lift type by door manufacturer, coordinate with Section 08 7100.
- C. Threshold: Provide sound control/acoustic seal for sill of door in closed position by door manufacturer.
- D. Sound Control Seals: Provide sound control/acoustic seals for jambs and head of door in closed position by door manufacturer.

2.07 FINISHES

- A. Primer, Metal Doors and Frames: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard, in compliance with local VOC requirements.

- B. Metal Door and Frame Finish: Complying with ANSI/SDI A250.3, manufacturer's standard coating.
 - 1. Color: As scheduled.
- C. Wood Door Finish: Complying with WDMA I.S. 1A, premium grade, stain and clear coating.
 - 1. Color: As scheduled.
- D. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

2.08 ACCESSORIES

- A. Glazing: Laminated heat strengthened annealed glass, 1/2 inch (12.7 mm) overall thickness, factory installed, and tested to comply with specified sound control and fire ratings as indicated.
- B. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.
- C. Grout for Frames: Portland cement grout with maximum of 4 inch slump for hand troweling; thinner pumpable grout of higher slump is not permitted.
 - 1. Grouting of frames in drywall/gypsum board construction is not permitted.
 - 2. Frame to be packed with 10 pound density mineral wool.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Install fire rated units in accordance with NFPA 80.
- C. Coordinate frame anchor placement with wall construction.
- D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- E. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 865.
- F. Factory installed glazing, comply with installation requirements; see Section 08 8000.
- G. Coordinate installation of electrical connections to electrical hardware items.
- H. Touch up damaged factory finishes.

3.04 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 865.
- B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

- A. Adjust for smooth and balanced sound control door movement.
- B. Adjust sound control doors so that seals are fully engaged when door is closed.

- C. Adjust sound control doors for force to close, latch, and unlatch; adjust as necessary in compliance with requirements.

END OF SECTION

**SECTION 08 4313
ALUMINUM-FRAMED STOREFRONTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum-framed storefront, with vision glass.
- B. Aluminum doors and frames.

1.02 RELATED REQUIREMENTS

- A. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.
- B. Section 08 8000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.
- B. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2015.
- C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).
- D. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- G. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- H. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
- I. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- J. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- K. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).
- L. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.
- M. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).
- N. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015.
- O. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with installation of other components that comprise the exterior enclosure.
- B. Preinstallation Meeting: Conduct a preinstallation meeting two weeks before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, internal drainage details.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
 - 1. Include design engineer's stamp or seal on shop drawings for attachments and anchors.
- D. Shop drawing sheets that include engineering information designed by the Contractor's Delegated Design Engineer shall be signed and sealed in accordance with the Texas Engineering Practice Act. Sheets that do not provide information designed by the Contractor's Engineer do not require being signed and sealed. Calculation packages require a signed and sealed cover sheet only. Any submittals requiring to be signed and sealed that are received without the signature and seal will be rejected without review.
- E. Samples: Accompanying the Shop Drawings, submit:
 - 1. Sample of each exposed member.
 - 2. Samples of finish, showing complete range of color from darkest to lightest proposed for use on this Work.
 - 3. Samples, when approved by the Architect, will be used to verify that the installed finish is within the approved range.
- F. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations stamped and signed by a Structural Engineer licensed in the State of Texas.
- G. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
- H. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.
- I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in Texas.
- B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a two year period after Date of Substantial Completion.
- C. Provide two year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

- D. Provide two year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING (EXTERIOR)

- A. Center-Set Style, Thermally-Broken:
 - 1. Basis of Design: Kawneer Company Inc; Trifab VG 451T Storefront System.
 - 2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
- B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
 - 1. Arcadia, Inc.: www.arcadiainc.com
 - 2. Atlas Architectural Metals, Inc.: www.atlasarchmetals.com.
 - 3. Columbia Commercial Building Products: ccbpwin.com.
 - 4. C.R. Laurence Company, Inc; U.S. Aluminum: www.crl-arch.com/sle.
 - 5. EFCO, a Pella Company: www.efcocorp.com/sle.
 - 6. Kawneer Company, Inc.: www.kawneer.com.
 - 7. Manko Window Systems, Inc.: www.mankowindows.com.
 - 8. Oldcastle BuildingEnvelope: www.oldcastlebe.com.
 - 9. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com.
 - 10. Tubelite, Inc.: www.tubeliteinc.com
 - 11. YKK AP America Inc: www.ykkap.com.
- C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 BASIS OF DESIGN -- FRAMING FOR MONOLITHIC GLAZING (INTERIOR)

- A. Center-Set Style:
 - 1. Basis of Design: Kawneer Company Inc; Trifab VG 451 Storefront System.
 - 2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
- B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
 - 1. Arcadia, Inc.: www.arcadiainc.com
 - 2. Atlas Architectural Metals, Inc.: www.atlasarchmetals.com.
 - 3. Columbia Commercial Building Products: ccbpwin.com.
 - 4. C.R. Laurence Company, Inc; U.S. Aluminum: www.crl-arch.com/sle.
 - 5. EFCO, a Pella Company: www.efcocorp.com/sle.
 - 6. Kawneer Company, Inc.: www.kawneer.com.
 - 7. Manko Window Systems, Inc.: www.mankowindows.com.
 - 8. Oldcastle BuildingEnvelope: www.oldcastlebe.com.
 - 9. Trulite Glass and Aluminum Solutions, LLC: www.trulite.com.
 - 10. Tubelite, Inc.: www.tubeliteinc.com
 - 11. YKK AP America Inc: www.ykkap.com.
- C. Substitutions: See Section 01 6000 - Product Requirements.

2.03 BASIS OF DESIGN -- SWINGING DOORS

- A. Wide Stile, Insulating Glazing, Not Thermally-Broken:
 - 1. Basis of Design: Kawneer Company Inc; 500 Heavy Wall Entrance Door.
 - 2. Thickness: 2 inches.
- B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
 - 1. Arcadia, Inc.: www.arcadiainc.com
 - 2. Atlas Architectural Metals, Inc.: www.atlasarchmetals.com.

3. Columbia Commercial Building Products: ccbpwin.com.
4. C.R. Laurence Company, Inc; U.S. Aluminum: www.crl-arch.com/sle.
5. EFCO, a Pella Company: www.efcocorp.com/sle.
6. Kawneer Company, Inc.: www.kawneer.com.
7. Manko Window Systems, Inc.: www.mankowindows.com.
8. Oldcastle BuildingEnvelope: www.oldcastlebe.com.
9. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com.
10. Tubelite, Inc.: www.tubeliteinc.com
11. YKK AP America Inc: www.ykkap.com.

C. Substitutions: See Section 01 6000 - Product Requirements.

2.04 STOREFRONT

- A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
1. Finish: Class I natural anodized.
 - a. Factory finish all surfaces that will be exposed in completed assemblies.
 2. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 3. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 4. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
 5. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
 6. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
 7. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
 8. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.
 9. Preparation for Window Treatments: Provide reinforced interior horizontal head rail.
- B. Performance Requirements:
1. General Requirements
 - a. Drawings are diagrammatic and do not purport to identify nor solve problems of thermal or structural movement, glazing, anchorage or moisture disposal.
 - b. Requirements shown by details are intended to establish basic dimension of units, sight lines and profiles of members.
 - c. Provide concealed fastening.
 - d. Provide entrance and storefront systems, including necessary modifications, to meet specified requirements and maintaining visual design concepts.
 - e. Attachment considerations are to take into account site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening or fracturing connection between units and building structure or between units themselves.
 - f. Anchors, fasteners and braces shall be structurally stressed not more than 50% of allowable stress when maximum loads are applied.

- g. Provide for expansion and contraction without detriment to appearance or performance.
- h. Assemblies shall be free from rattles, wind whistles and noise due to thermal and structural movement and wind pressure.
- i. Not Permitted: Vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system.
- j. Coordinate all door hardware with Section 08 7100 – Door Hardware.
2. Frame calculations shall be designed by a registered engineer in the State of Texas. Manufacturer is responsible for system reinforcing.
3. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
 - a. Design Wind Loads: Comply with requirements of ASCE 7.
 - b. Member Deflection: Limit member deflection to 1/175 in any direction, with full recovery of glazing materials.
4. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf.
5. Air Leakage Laboratory Test: Maximum of 0.06 cu ft/min sq ft of wall area, when tested in accordance with ASTM E283 at 6.27 psf pressure differential across assembly.
6. Thermal Requirements:
 - a. Framing systems shall accommodate expansion and contraction movement due to surface temperature differentials of 180° F without causing buckling, stress on glass, failure of joint seals, excessive stress on structural elements, reduction of performance, or other detrimental effects.
 - b. Ensure doors function normally within limits of specified temperature range.
 - c. Thermal Break with a 1/4" separation consisting of a two part chemically curing, high density polyurethane which is mechanically and adhesively joined to aluminum storefront sections.

1.02 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, drainage holes and internal weep drainage system.
 1. Framing members for interior applications need not be thermally broken.
 2. Glazing Stops: Flush.
 3. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.
 4. High Performance Sub Sill.
- B. Aluminum Subframing and Subsills: Extruded aluminum, thermally broken to match framing members where required, integrate with framing member drainage system.
 1. Finish: Same as storefront.
 2. Subframing: At perimeter of units, where indicated.
 3. Flat Fillers: At head and jambs of exterior units where no subframing is indicated.
 4. Sub-sills: At high-performance sills at exterior units.
- C. Glazing: As specified in Section 08 8000.
- D. Swing Doors: Glazed aluminum.
 1. Thickness: 2 inches. with .188 inch wall thickness
 2. Top Rail: 5 inches wide. Provide manufacturer's closure plate as required to accept door closure.
 3. Vertical Stiles: 5 inches wide.
 4. Mid Rail: 8 1/4 inches wide.
 5. Bottom Rail: 10 inches wide.

6. Glazing Stops: Square.
7. Finish: Same as storefront.

1.03 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
 - B. Sheet Aluminum: ASTM B209 (ASTM B209M).
 - C. Structural Steel Sections: ASTM A36/A36M; galvanized in accordance with requirements of ASTM A123/A123M.
 - D. Internal Reinforcing:
 1. ASTM A36 for carbon steel; or ASTM B308 for structural aluminum.
 2. Shapes and sizes to suit installation.
 3. Shop coat steel components after fabrication with alkyd type zinc chromate primer complying with FS TT-P-645.
 - E. Anchorage Devices:
 1. Manufacturer's standard formed or fabricated steel or aluminum assemblies of shapes, plates, bars or tubes.
 - F. Fasteners:
 1. Aluminum, non-magnetic stainless steel or other materials warranted by manufacturer to be non-corrosive and compatible with components being fastened.
 2. Do not use exposed fasteners, except where unavoidable for application of hardware.
 3. For exposed locations, provide countersunk Phillips head screws with finish matching items fastened.
 4. For concealed locations, provide manufacturer's standard fasteners.
 5. Provide nuts or washers of design having means to prevent disengagement; deforming of fastener threads is unacceptable.
 - G. Exposed Flashings: Aluminum sheet, 20 gage, 0.032 inch minimum thickness; finish to match framing members.
 - H. Glazing Reducer:
 1. 451-VG-029 Snap-in 1/4" infill adapter or equal by the frame manufacturer for storefront located at interior locations.
 - I. Glazing Gaskets:
 1. Compression type design, replaceable, molded or extruded, of neoprene, or ethylene propylene diene monomer (EPDM).
 2. Conform to ASTM C509 or C864.
 3. Profile and hardness as required to maintain uniform pressure for watertight seal.
 4. Provide in manufacturer's standard black color.
 - J. Weatherstripping:
 1. Wool pile conforming to AAMA 701.2; or extruded EPDM elastomeric conforming to ASTM C509 or C864.
 2. Provide EPDM or vinyl-blade gasket weatherstripping in bottom door rail, adjustable for contact with threshold.
 - K. "Anti-Walk" Edge Blocking: "W" shaped EPDM blocks for use in keeping glazing material stationary under vibration or seismic loading.
 - L. Baffles (at weep holes): Type as recommended by system manufacturer and shown in published installation instructions.
 - M. Glazing Accessories: As specified in Section 08 8000.
 - N. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.
-

1.04 FINISHES

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.
- B. Touch-Up Materials: As recommended by coating manufacturer for field application.

1.05 FABRICATION

- A. Coordination of Fabrication:
 - 1. Check actual frame or door openings required in construction work by accurate field measurements before fabrication.
 - 2. Fabricate units to withstand loads which will be applied when system is in place.
- B. General:
 - 1. Conceal fasteners wherever possible.
 - 2. Reinforce work as necessary for performance requirements and for support to structure.
 - 3. Comply with Section 08 8000 for glazing requirements.
- C. Aluminum Framing:
 - 1. Provide members of size, shape and profile indicated, designed to provide for glazing from interior.
 - 2. Fabricate frame assemblies with joints straight and tight fitting.
 - 3. Maintain accurate relation of planes and angles, with hairline fit of contacting members.
 - 4. Seal horizontals and direct moisture accumulation to exterior.
 - 5. Provide flashings and other materials used internally or externally that are corrosive resistant, non-staining, non-bleeding and compatible with adjoining materials.
 - 6. Provide manufacturer's extrusions and accessories to accommodate expansion and contraction due to temperature changes without being detrimental to appearance or performance.
 - 7. Make provisions in framing for minimum edge clearance, nominal edge cover and nominal pocket width for thickness and type of glazing or infill used in accordance with recommendations of manufacturer.
 - 8. Provide tight fitting, injection molded, plastic water deflectors at all intermediate horizontals.
 - 9. Provide thermally broken aluminum backer plate at perimeter of all windows and individual sealed aluminum caps at the top of all vertical window frame mullions.
 - 10. Provide fully soldered/sealed end dams at ends of subsill system.
- D. Entrance Doors:
 - 1. Fabricate with mechanical joints using internal reinforcing plates and shear blocks attached with fasteners and by welding.
 - 2. Provide extruded aluminum glazing stops of square design, permanently anchored on security side and removable on opposite side.
- E. Welding:
 - 1. Comply with recommendations of the American Welding Society.
 - 2. Use recommended electrodes and methods to avoid distortion and discoloration.
 - 3. Grind exposed welds smooth and flush with adjacent surfaces; restore mechanical finish.
- F. Flashings: Form from sheet aluminum with same finish as extruded sections. Apply finish after fabrication. Material thickness as required to suit condition without deflection or "oil-canning".

1.06 HARDWARE

- A. Receive hardware supplied in accordance with Section 08 7100 – Door Hardware and install in accordance with requirements of this Section.
 - B. Cut, reinforce, drill and tap frames and doors as required to receive hardware.
 - C. Comply with hardware manufacturer's templates and instructions.
-

- D. Use concealed fasteners wherever possible.

PART 3 EXECUTION

2.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

2.02 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Verify exterior substrates and weather barriers have been completed to ensure proper air/water tight transition is maintained.
- D. Provide alignment attachments and shims to permanently fasten system to building structure.
- E. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- F. Provide thermal isolation where components penetrate or disrupt building insulation.
- G. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- H. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- I. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- J. Install operating sash.
- K. Set thresholds in bed of sealant and secure.
- L. Install hardware using templates provided.
- M. Install glass and infill panels in accordance with Section 08 8000, using glazing method required to achieve performance criteria.
- N. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

2.03 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

2.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general testing and inspection requirements.
- B. Air/Water Leakage Testing: Provide chamber test per ASTM E1105 at 10% of glazing area per building, to be performed at mockup, 35% and 50% completion.
 - 1. Testing to be performed at 0.67 times the ASTM E331 rated pressure provided by the manufacturer for the system, not less than 5.6 psf.
- C. Water-Spray Test: Provide water spray quality test of installed storefront components in accordance with AAMA 501.2 during construction process and before installation of interior finishes.
 - 1. Perform a minimum of two tests in each designated area as indicated on drawings.
 - 2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.

2.05 ADJUSTING

- A. Test door operating functions. Adjust closing and latching speeds and other hardware in accordance with manufacturer's instructions to ensure smooth operation.
- B. Adjust operating hardware for smooth operation.

2.06 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

2.07 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

**SECTION 08 7100
DOOR HARDWARE**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
1. Swinging doors.
 2. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
1. Mechanical door hardware.
 2. Electromechanical door hardware.
 3. Cylinders specified for doors in other sections.
- C. Related Sections:
1. Division 08 Section "Door Hardware Schedule".
 2. Division 08 Section "Hollow Metal Doors and Frames".
 3. Division 08 Section "Interior Aluminum Doors and Frames".
 4. Division 08 Section "Plastic Laminate Faced Wood Doors".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 2. ICC/IBC - International Building Code.
 3. NFPA 70 - National Electrical Code.
 4. NFPA 80 - Fire Doors and Windows.
 5. NFPA 101 - Life Safety Code.
 6. NFPA 105 - Installation of Smoke Door Assemblies.
 7. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards:
1. ANSI/BHMA Certified Product Standards - A156 Series
 2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 - 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:
 - 1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
 - c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Proof of Certification: Provide copy of manufacturer(s) official certification or accreditation document indicating proof of status as a qualified installer of Windstorm assemblies.
- E. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- F. Informational Submittals:
 1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- G. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Installer Qualifications: A minimum 3 years documented experience hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- D. Integrated Wiegand, Wireless, and IP-Enabled Access Control Products Supplier Qualifications: Integrated access control products and accessories are required to be supplied and installed through current members of the ASSA ABLOY "Authorized Channel Partner" (ACP) and "Certified Integrator" (CI) programs. Suppliers are to be factory trained, certified prior to project bid, and a direct purchaser of the specified product. Installers are to be factory trained, certified prior to project bid, and are responsible for commissioning, servicing, and warranting the installed equipment specified for the project.
- E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated
- F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
1. Function of building, purpose of each area and degree of security required.
 2. Plans for existing and future key system expansion.
 3. Requirements for key control storage and software.
 4. Installation of permanent keys, cylinder cores and software.
 5. Address and requirements for delivery of keys.
- H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 3. Review sequence of operation narratives for each unique access controlled opening.
 4. Review and finalize construction schedule and verify availability of materials.
 5. Review the required inspecting, testing, commissioning, and demonstration procedures
- I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site.
 - B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
 - C. Deliver, as applicable, permanent keys, cylinders, cores and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
 - 1. Lifetime for mortise locks and latches.
 - 2. Five years for exit hardware.
 - 3. Ten years for electric latch retraction exit motors
 - 4. Twenty-five years for manual surface door closer bodies.
 - 5. Two years for electromechanical door hardware.
 - 6. Lifetime for SN200 readers.

1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

1.9 OWNER STOCK – See Attic Stock at the end of Hardware Schedule.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
- C. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- D. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.
 - 1. Quantity: Provide the following hinge quantity, unless otherwise indicated:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 - 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
 - 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following where indicated in the Hardware Sets or on Drawings:
 - a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Acceptable Manufacturers:
 - a. Hager Companies (HA).
 - b. McKinney Products (MK).
 - c. Stanley Hardware (ST).

- B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Acceptable Manufacturers:
 - a. McKinney Products (MK).
 - b. Pemko Manufacturing (PE).
 - c. Stanley Hardware (ST).

2.3 POWER TRANSFER DEVICES

- A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Acceptable Manufacturers:
 - a. Pemko Manufacturing (PE) – EL-CEPT Series.
 - b. Securitron (SU) - EL-CEPT Series.
 - c. Stanley Hardware (ST) EPT-12C Series.

- B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:
 - a. McKinney Products (MK) - Electrical Connecting Kit: QC-R001.

- b. McKinney Products (MK) - Connector Hand Tool: QC-R003.

2.4 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
 - 1. Manual flush bolts to be furnished with top rod of sufficient length to allow bolt location approximately six feet from the floor.
 - 2. Furnish dust proof strikes for bottom bolts.
 - 3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
 - 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
 - 5. Acceptable Manufacturers:
 - a. Ives (IV).
 - b. Rockwood Manufacturing (RO).
 - c. Trimco (TC).
- B. Door Push Plates and Pulls: ANS/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
 - 1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
 - 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
 - 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
 - 4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
 - 5. Acceptable Manufacturers:
 - a. Ives (IV).
 - b. Rockwood Manufacturing (RO).
 - c. Trimco (TC).

2.5 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
 - 1. Acceptable Manufacturers:
 - a. Stanley Best (BE).

- b. Sargent Cylinder Housings
 - c. No Substitution.
- C. Cylinders: Original manufacturer cylinders complying with the following:
 - 1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
 - 2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 - 3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
 - 4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 - 5. Keyway: Match Facility Standard.
- D. Keying System: Each type of lock and cylinders to be factory keyed.
 - 1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
 - 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 - 3. Existing System: Key locks to Owner's existing system.
- E. Key Quantity: Provide the following minimum number of keys:
 - 1. Change Keys per Cylinder: Two (2)
 - 2. Twenty construction cores
 - 3. 50 Key Blanks – Best "A" Keyway
- F. Construction Keying: Provide temporary keyed construction cores. Green Best Cores No Substitution . All Best temporary cores to be returned to the district at the end of the project.
- G. Key Registration List (Bitting List):
 - 1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
 - 2. Provide transcript list in writing or electronic file as directed by the Owner.
- H. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project. Provide a new cabinet to all new construction projects. Use Lund 1205-B as a basis of design.
 - 1. Acceptable Manufacturers:
 - a. Lund Equipment (LU).
 - b. MMF Industries (MM).
 - c. Telkee (TK).

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.
1. Acceptable Manufacturers
 - a. Sargent Manufacturing (SA) 8200 Series – No substitutions
 - b. Sargent Manufacturing (SA) 10X Series - No substitutions
 - 1) Use at student restrooms or as directed by Cy Fair ISD

2.7 AUXILIARY LOCKS

- A. Tubular Deadlocks: Deadlocks to be products of the same source manufacturer and keyway as other specified locksets.
1. Acceptable Manufacturers:
 - a. Marks (MX) - 130 Series.
 - b. Sargent Manufacturing (SA) – 480 Series.

2.8 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 2. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
- B. Standards: Comply with the following:
1. Strikes for Mortise Locks and Latches: BHMA A156.13.
 2. Strikes for Auxiliary Deadlocks: BHMA A156.5.
 3. Dustproof Strikes: BHMA A156.16.

2.9 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.

2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
 3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
 4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
 5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
 6. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 7. Through Bolt Installation: For exit devices and trim as indicated (TB) in Door Hardware Sets.
 8. Provide Less Dogging (LD) at all exit devices.
 9. Add 31- Prefix to all exit devices being provided at two inch aluminum doors.
 10. No self-tapping screws allowed.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.
1. Acceptable Manufacturers:
 - a. Sargent Manufacturing (SA) - 80 Series.
 - b. No Substitution.
- C. Tube Steel Removable Mullions: ANSI/BHMA A156.3 removable steel mullions with malleable-iron top and bottom retainers and a primed paint finish.
1. Provide keyed removable feature where specified in the Hardware Sets.
 2. Provide stabilizers and mounting brackets as required.
 3. Provide electrical quick connection wiring options as specified in the hardware sets.
 4. Acceptable Manufacturers:
 - a. Stanley Precision (PR) - 822 Series.

- b. No Substitution.

2.10 INTEGRATED WIEGAND OUTPUT ACCESS CONTROL EXIT DEVICES

- A. Wiegand Output Integrated Card Reader Exit Hardware: Wiegand output ANSI 156.3 Grade 1 rim, mortise, and vertical rod exit device hardware with integrated proximity card reader, latchbolt and touchbar monitoring, and request-to-exit signaling, in one complete unit. Hard wired, solenoid driven locking/unlocking control of the lever handle exit trim with 3/4" throw latch bolt. U.L listed and labeled for either panic or "fire exit hardware" for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.
 - 1. Open architecture, hard wired platform supports centralized control of locking units with new or existing Wiegand compatible access control systems. Inside push bar (request-to-exit) signaling and door position (open/closed status) monitoring (via separately connected DPS).
 - 2. Reader supports either HID 125 kHz proximity (up to 39 bits, including Corporate 1000) or 13.56 MHz (2K-32K) iClass® credentials.
 - 3. 12VDC external power supply required for reader, with optional 24VDC operation available with iClass® reader (125 kHz reader is always 12VDC). 24VDC required for solenoid operated exit trim (12VDC if applicable). Fail safe or fail secure options.
 - 4. Installation requires only one cable run from the exit hardware to the access control panel without requirements for additional proprietary lock panel interface boards or modules.
 - 5. Acceptable Manufacturers:
 - a. Sargent Manufacturing (SA) - SN – 56-SN20080 Series Exits. x SPAR04867
 - b. Sargent Manufacturing (SA) - SN – SN2008200 Series Locks.
 - c. No Substitution.

2.11 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
 - 1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
 - 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 - 3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
 - 4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
 - 5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates, and through-bolt and security type fasteners as required for proper installation.
8. Through Bolt Installation: All door closers are to be installed with (TB) through bolting as indicated in Door Hardware Sets.
9. No self-tapping screws allowed.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Acceptable Manufacturers:
 - a. Sargent Manufacturing (SA) – TB 351 Series.

2.12 SURFACE MOUNTED CLOSER HOLDERS

A. Electromagnetic Door Holders: Certified ANSI A156.15 electromagnetic door holder/releases with a minimum 20 to 40 pounds holding power and single coil construction able to accommodate 12VDC, 24VAC, 24VDC and 120VAC. Coils to be independently wound, employing an integral fuse and armatures to include a positive release button.

1. Acceptable Manufacturers:
 - a. LCN Door Closers (LC) - SEM7800 Series.
 - b. Rixson (RF) - 980/990 Series.
 - c. Sargent Manufacturing (SA) - 1560 Series.

2.13 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, 050-inch thick.
4. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
5. Acceptable Manufacturers:
 - a. Ives (IV).
 - b. Rockwood Manufacturing (RO).
 - c. Trimco (TC).

2.14 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 1. Acceptable Manufacturers:
 - a. Ives (IV).
 - b. Rockwood Manufacturing (RO).
 - c. Trimco (TC).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
 1. Acceptable Manufacturers:
 - a. Do not use overhead stops/holders

2.15 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and UBC 7-2, Fire Tests of Door Assemblies.
- D. No Replaceable Seal Strips allowed: Provide only those units where they can be screw applied..
- E. Acceptable Manufacturers:
 - 1. National Guard Products (NG).
 - 2. Pemko Manufacturing (PE).
 - 3. Reese Enterprises, Inc. (RE).

2.16 ELECTRONIC ACCESSORIES

- A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.
 - 1. Acceptable Manufacturers:
 - a. Provided by Security
- B. Switching Power Supplies: Provide UL listed or recognized filtered and regulated power supplies. Provide single, dual, or multi-voltage units as shown in the hardware sets. Units must be expandable up to eight Class 2 power limited outputs. Units must include the capability to incorporate a battery backup option with integral battery charging capability in addition to operating the DC load in event of line voltage failure. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
 - 1. Acceptable Manufacturers:
 - a. Provided by Security

2.17 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.18 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."

- 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
 - C. Integrated Wiegand access control products are required to be installed through current members of the ASSA ABLOY "Certified Integrator" (CI) program.
 - D. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
 - F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.
 - G. No self-tapping screws allowed.
- 3.4 FIELD QUALITY CONTROL
- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.
- 3.5 ADJUSTING
- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - B. Final Adjustment: Installer shall return and make final adjustment of all hardware once all air conditioning test and balance is complete. Final adjustment shall be made while air conditioner system is operating. Coordinate with General Contractor and Owner.
- 3.6 CLEANING AND PROTECTION
- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
 - B. Clean adjacent surfaces soiled by door hardware installation.
 - C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

A. Manufacturer's Abbreviations:

1. MK - McKinney
2. OT - OTHER
3. PE - Pemko
4. RO - Rockwood
5. PR - Precision
6. MX - Marks
7. SA - Sargent
8. AD - Adams Rite
9. BE - Best Access Systems
10. HS – HES
11. SU – Securitron
12. KD – Keedex
13. LO – Locinox

Hardware Sets based on plans dated 08-28-2024
10/10/2024 – Revised based on 75% Owner Note Review – 09/02/2024 Plans

****At existing doors / frames, all conditions must be field verified prior to order.**
At aluminum frames, gasket is by frame manufacturer.
****Add 2891APK gasketing to all exterior hollow metal doors.**

Set: 1.0

Doors: D150B
Description: 2N Station

1	All hardware	Existing to remain		OT
1	2N Station	2N		OT

Set: 2.0

Doors: F101A
Description: Add Reader - 68-1375 Rail - Pivots

2	Pivots	New - by Storefront Supplier		OT
1	68-1375	Mounting Rail Insert		SA
2	Door Stop	462	US2C	RO
2	Sweep IDF/MDF/Alum	18061CNB x Dr. Width		PE
1	SN200 Reader	52 6027 (Exit / Lock)	26D	SA
1	Balance of hardware	Existing to remain		OT

Notes: Remove cylinder dogging on exiting rail with 68-1375 mounting rail insert.

Set: 3.0

Doors: D111, E131B, G101, I115A, I115B, I119A, I119B
Description: Add Reader - Pr Rail Insert - Sweeps Stop

1	68-1375	Mounting Rail Insert		SA
2	Door Stop	462	US2C	RO
2	Sweep IDF/MDF/Alum	18061CNB x Dr. Width		PE
1	SN200 Reader	52 6027 (Exit / Lock)	26D	SA
1	Balance of hardware	Existing to remain		OT

Notes: Remove cylinder dogging on exiting rail with 68-1375 mounting rail insert.
*Replace HID reader on wall with SN200 reader.

Set: 4.0

Doors: J129
Description: Add Reader - Pr Rail Insert - 68-0549

1	68-0549	Rail Inserts		SA
2	Door Stop	462	US2C	RO
1	Gasketing	2891APK (head & jambs)		PE
1	SN200 Reader	52 6027 (Exit / Lock)	26D	SA
1	Balance of hardware	Existing to remain		OT

Notes: Remove cylinder dogging on exiting rail with 68-1375 mounting rail insert.
*Replace HID reader on wall with SN200 reader.

Set: 5.0

Doors: I116

Description: Add Reader - 68-1375 Rail Insert - Sweeps Stops

1	68-1375	Mounting Rail Insert		SA
2	Door Stop	462	US2C	RO
2	Sweep IDF/MDF/Alum	18061CNB x Dr. Width		PE
1	SN200 Reader	52 6027 (Exit / Lock)	26D	SA
1	Balance of hardware	Existing to remain		OT

Notes: Remove cylinder dogging on rail with 68-1375 mounting rail insert

Set: 6.0

Doors: F101B

Description: Add 68-1375 Rail Insert - 2 - Pivots

2	Pivots	New - by Storefront Supplier		OT
2	68-1375	Mounting Rail Insert		SA
1	Balance of hardware	Existing to remain		OT

Notes: Remove cylinder dogging on rail with 68-1375 mounting rail insert

Set: 7.0

Doors: F124A

Description: Add Int 68-1375 Rail Insert - Trim-Mullion, HO Closer

1	Mullion	KR822 (FLK as req)	600	PR
2	Stabilizer	ST989	Dull Black	PR
1	Spacer	MCS822	689	PR
1	68-0549	Rail Inserts		SA
2	Exit Device Trim	70 713-8ETL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Mullion Cylinder	70 34 x 1KB-3	US32D	SA
1	Const. Core	7190224	Green	BE
2	Door Closer w/ HO	TB 351 H (inswing)/ PSH (outswing) As Req	EN	SA
2	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Notes: Remove cylinder dogging on rail with 68-1375 mounting rail insert

Set: 8.0

Doors: E109, E111, E113, E115, E124, E125, E126, E127, E128, E129, E145, E149A, E150

Description: Add Rated Exit Device-Security CL

1	Rim Exit Rated Sec CR x SPAR#NC-E11		12 LD 19 43 49 70 8816	
	ETL	US32D	SA	
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Notes: Provide hold open closers at classrooms unless fire rated. No hold open on rated doors.

Set: 9.0

Doors: B115A, B119A, B122A, B124B, B203A, B205A, B211A, F105A, G111A, G114A, G135A, G136A, G171A, H161, H165A

Description: Add Exit Device-8816- HO Closers

1	Rim Exit Sec CR x SPAR#NC-E11	19 LD 43 49 70 8816 ETL	US32D	SA
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
1	Surface Closer	TB 351 PSH	EN	SA
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Notes: Provide hold open closers at classrooms unless fire rated. No hold open on rated doors.

Set: 10.0

Doors: A111, A113A, A113B, C218, C219, C220, C221, C225, C226, C227, C228, C241, C242, C243, C244, C245, C246, C247, C248, C251, C252, C253, C254, C257, C258, C259, C260, D237A, E215, E216, E217, E218, E221, E222, E223, E224, E236, E237, E238, E239, E241, E242, E243, E244, E251, E252, E253, E254, E257, E258, E259, E261, J117B, J117C, J128A, J128B, J168, J169

Description: Add Exit Device-8816- HO Closers - Thru bolts

1	Rim Exit Sec CR x SPAR#NC-E11	19 LD 43 49 70 8816 ETL	US32D	SA
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
1	Sex Nut & Bolt Kit	SNB134-38	689	NO
1	Surface Closer	TB 351 PSH	EN	SA
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Notes: Provide hold open closers at classrooms unless fire rated. No hold open on rated doors.

**TB Kit to be used to fill existing pull preps.

Set: 11.0

Doors: D237B

Description: Add Exit Device-8804- HO Closers - Thru bolts

1	Rim Exit NL SPAR#NC-E11	LD 19 43 70 8804 ETL	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Sex Nut & Bolt Kit	SNB134-38	689	NO
1	Surface Closer	TB 351 PSH	EN	SA
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Notes: Provide hold open closers at classrooms unless fire rated. No hold open on rated doors.

**TB Kit to be used to fill existing pull preps.

Set: 12.0

Doors: J155A, J155B

Description: Add Exit Device-8816/8804- HO Closers - Thru bolts

1	Rim Exit Sec CR x SPAR#NC-E11	LD 19 LD 43 49 70 8816 ETL	US32D	SA
1	Rim Exit NL SPAR#NC-E11	LD 19 43 70 8804 ETL	US32D	SA
3	Interchangeable Core	I/CK-7	626	BE
3	Const. Core	7190224	Green	BE
2	Sex Nut & Bolt Kit	SNB134-38	689	NO
2	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Notes: Provide hold open closers at classrooms unless fire rated. No hold open on rated doors.
**TB Kit to be used to fill existing pull preps.

Set: 13.0

Doors: F119A, F119B

Description: Add Exit Device-8816/8804- HO Closers - Mullion

1	Mullion	KR822 (FLK as req)	600	PR
2	Stabilizer	ST989	Dull Black	PR
1	Spacer	MCS822	689	PR
1	Rim Exit Sec CR x SPAR#NC-E11	LD 19 LD 43 49 70 8816 ETL	US32D	SA
1	Rim Exit NL SPAR#NC-E11	LD 19 43 70 8804 ETL	US32D	SA
4	Interchangeable Core	I/CK-7	626	BE
1	Mullion Cylinder	70 34 x 1KB-3	US32D	SA
4	Const. Core	7190224	Green	BE
2	Surface Closer	TB 351 PSH	EN	SA
2	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Notes: Provide hold open closers at classrooms unless fire rated. No hold open on rated doors.

Set: 14.0

Doors: J101A, J101B, J101G, J101H, J107A, J107B, J107C

Description: Add Rated Exit Device-8816/8804- Closers - Thru bolts - Mullion

1	Mullion	KR822 (FLK as req)	600	PR
2	Stabilizer	ST989	Dull Black	PR
1	Spacer	MCS822	689	PR
1	Rim Exit Rated Sec CR x SPAR#NC-E11		12 LD 19 43 49 70 8816	
		ETL	US32D	SA
1	Rim Exit SPAR NC-E11	12 LD 19 TB 43 70 8804 ETL	US32D	SA
4	Interchangeable Core	I/CK-7	626	BE
1	Mullion Cylinder	70 34 x 1KB-3	US32D	SA
4	Const. Core	7190224	Green	BE
2	Sex Nut & Bolt Kit	SNB134-38	689	NO
2	Surface Closer	TB 351 PS	EN	SA
2	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Notes: Provide hold open closers at classrooms unless fire rated. No hold open on rated doors.
**TB Kit to be used to fill existing pull preps.

Set: 15.0

Doors: B115B, B117, B122B, B124A, B203B, B205B, B211B, F105B, H165B

Description: Add Exit Device-8804- HO Closers

1	Rim Exit NL SPAR#NC-E11	LD 19 43 70 8804 ETL	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Surface Closer	TB 351 PSH	EN	SA
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Notes: Provide hold open closers at classrooms unless fire rated. No hold open on rated doors.

Set: 16.0

Doors: H102B

Description: Add Ext Exit Device-8804 FSW

1	Rim Exit x SPAR#NC-E11	LD 19 TB 43 70 8804 FSW	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	481H	US26D	RO
1	Gasketing	2891APK (head & jambs)		PE
1	Balance of hardware	Existing to remain		OT

Notes:

Set: 17.0

Doors: I129B

Description: Add Int Rated Exit Device-8804 FSW

1	Continuous Hinge	CFM HD1 x Dr. Ht.		PE
1	Rim Exit Device, Storeroom	12 LD 19 TB 43 70 8804 FSW	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Closer	TB 351 O/P9 (type as required)	EN	SA
1	Door Stop	481H	US26D	RO
1	Gasketing	2891APK (head & jambs)		PE
1	Balance of hardware	Existing to remain		OT

Notes:

Set: 18.0

Doors: I120A

Description: Add Exit Device-8816- HO Closers - repair

1	Rim Exit Sec CR x SPAR#NC-E11	19 LD 43 49 70 8816 ETL	US32D	SA
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
1	Surface Closer	TB 351 PSH	EN	SA
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Notes: Provide hold open closers at classrooms unless fire rated. No hold open on rated doors. Contractor to paint and bondo any existing holes.

Set: 19.0

Doors: B121, C108, C120, C133, D114B, D185B, D187, E131A, E131C, G129A, G129B

Description: Add Pr SN200 Narrow Exit x Less Trim, EPT, Rail Insert, Sweeps,

1	Electric Power Transfer	EL-CEPT	630	SU
1	68-1375	Mounting Rail Insert		SA
1	Rim Exit xSPAR04867/NC-E11/NC-E35		19 LD TB 43 70 56-	
	SN200-8504 Less Trim	US32D	SA	
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
2	Door Stop	462	US2C	RO
2	Sweep IDF/MDF/Alum	18061CNB x Dr. Width		PE
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Power Supply	Provided by security		SU
1	Balance of hardware	Existing to remain		OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times. Reuse existing trim. Remove cylinder dogging on exit rail, replace with 68-1375 Mounting Rail Insert.

Set: 20.0

Doors: J101C, J101E

Description: Add Pr DT only, Rail Insert, Sweeps - Dogging

1	68-1375	Mounting Rail Insert		SA
1	Rim Exit x SPAR#NC-E11	19 TB 43 8510 862	US32D	SA
2	Door Stop	462	US2C	RO
2	Sweep IDF/MDF/Alum	18061CNB x Dr. Width		PE
1	Balance of hardware	Existing to remain		OT

Notes: Remove cylinder dogging on exit rail, replace with 68-1375 Mounting Rail Insert.

Set: 21.0

Doors: A102, B114

Description: Add SN200 Narrow Exit 8504 x 8510, EPT Less Trim

1	Electric Power Transfer	EL-CEPT	630	SU
1	Rim Exit SPAR NC-E11	LD 19 TB 43 8510 EO	US32D	SA
1	Rim Exit xSPAR04867/NC-E11/NC-E35		19 LD TB 43 70 56-	
	SN200-8504 Less Trim	US32D	SA	
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
2	Door Stop	462	US2C	RO
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Power Supply	Provided by security		SU
1	Balance of hardware	Existing to remain		OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times.

Set: 22.0

Doors: J101D, J101F

Description: Add SN200 Narrow Exit 8504 x 8510, EPT x Trim - Sweep / Stop

1	Electric Power Transfer	EL-CEPT	630	SU
1	Rim Exit x SPAR04867/NC-E11/NC-E35		19 LD TB 43 70 56-	
	SN200-8504 862	US32D	SA	
1	68-1375	Mounting Rail Insert		SA
1	Rim Exit x SPAR#NC-E11	19 TB 43 8510 862	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
2	Door Stop	462	US2C	RO
2	Sweep IDF/MDF/Alum	18061CNB x Dr. Width		PE
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Power Supply	Provided by security		SU
1	Balance of hardware	Existing to remain		OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times.

Set: 23.0

Doors: A150B, A150C

Description: Add SN200 Exit, Loop, Rail Insert - Mullion

1	Mullion	KR822 (FLK as req)	600	PR
2	Stabilizer	ST989	Dull Black	PR
1	Spacer	MCS822	689	PR
1	Rim Exit x SPAR04867/NC-E11	19 LD TB 43 70 56-SN200-8804	US32D	SA
1	68-0549	Rail Inserts		SA
2	Interchangeable Core	I/CK-7	626	BE
1	Mullion Cylinder	70 34 x 1KB-3	US32D	SA
2	Const. Core	7190224	Green	BE
2	Door Stop	462	US2C	RO
2	Sweep	345ANB x Dr. Width		PE
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Door Loop	DL-2		AK
1	Power Supply	Provided by security		SU
1	Balance of hardware	Existing to remain		OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times. Reuse existing Trim. Remove cylinder dogging on exiting rail with 68-0549 mounting rail insert

Set: 24.0

Doors: E164B, E165B, H130, H171A, H171B

Description: Add SN200 Exit, Loop

1	Rim Exit x SPAR04867/NC-E11	19 LD TB 43 70 56-SN200-8804	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	462	US2C	RO
1	Gasketing	2891APK (head & jambs)		PE

1	ElectroLynx Harness	QC-C1500P	MK
2	ElectroLynx Harness	QC-C***P (length as req'd)	MK
1	Door Loop	DL-2	AK
1	Power Supply	Provided by security	SU
1	Balance of hardware	Existing to remain	OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times. Reuse existing Trim. Remove cylinder dogging on exiting rail with 68-1375 mounting rail insert

Set: 25.0

Doors: B100A, D151, E152B, E160B, I101

Description: Add SN200 Exit, Loop - Sweep

1	Rim Exit x SPAR04867/NC-E11	19 LD TB 43 70 56-SN200-8804	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
1	Door Stop	462	US2C	RO
1	Sweep	345ANB x Dr. Width		PE
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Door Loop	DL-2		AK
1	Power Supply	Provided by security		SU
1	Balance of hardware	Existing to remain		OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times. Reuse existing Trim. 2 sweeps/2stops at pairs.

Set: 26.0

Doors: E166B

Description: Add Pr SN200 Exit, Loop - Sweep - Rail Insert

1	Rim Exit x SPAR04867/NC-E11	19 LD TB 43 70 56-SN200-8804	US32D	SA
1	68-0549	Rail Inserts		SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
2	Door Stop	462	US2C	RO
2	Sweep	345ANB x Dr. Width		PE
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Door Loop	DL-2		AK
1	Power Supply	Provided by security		SU
1	Balance of hardware	Existing to remain		OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times. Reuse existing Trim. 2 sweeps/2stops at pairs.

Set: 27.0

Doors: H114

Description: Add 2N Exit, Loop

1	Rim Exit - 2N SPAR#04867/NC-E11	LD 19 TB 43 56 70 8804 Less Pull	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	481H	US26D	RO
1	Gasketing	2891APK (head & jambs)		PE
1	ElectroLynx Harness	QC-C1500P		MK
1	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Door Loop	DL-2		AK
1	Power Supply	Provided by security		SU
1	Balance of hardware	Existing to remain		OT
1	Reader	By Security contractor		OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times. Card reader by security. Reuse existing Trim.

Set: 28.0

Doors: A101A, A101B, A101C

Description: Pair Add Rated Exit Devices-8816 x 8804 - TB - Mullion

1	Mullion	KR822 (FLK as req)	600	PR
2	Stabilizer	ST989	Dull Black	PR
1	Spacer	MCS822	689	PR
1	Rim Exit Rated Sec CR x SPAR#NC-E11		12 LD 19 43 49 70 8816	
	ETL	US32D	SA	
1	Rim Exit SPAR NC-E11	12 LD 19 TB 43 70 8804 ETL	US32D	SA
4	Interchangeable Core	I/CK-7	626	BE
1	Mullion Cylinder	70 34 x 1KB-3	US32D	SA
4	Const. Core	7190224	Green	BE
1	Sex Nut & Bolt Kit	SNB134-38	689	NO
2	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Set: 29.0

Doors: A150A

Description: Pair Add Exit Devices-8816 x 8804

1	Rim Exit SPAR NC-E11	LD 19 TB 43 70 8804 ETL	US32D	SA
1	Rim Exit Sec CR x SPAR#NC-E11	19 LD 43 49 70 8816 ETL	US32D	SA
3	Interchangeable Core	I/CK-7	626	BE
3	Const. Core	7190224	Green	BE
2	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Set: 30.0

Doors: A104, A112B, A118, A151, A154, B106, B107, B108, B109, B116, B118A, B118B, B118C, B123A, B123B, B123C, B201, C103A, C103B, C103C, C103D, C103E, C107, C111A, C111B, C112A, C112B, C112C, C112D, C112E, C112F, C113, C116, C121, C122, C123, C126, C128A, C128B, C128C, C128D, C128E, C137A, C137B, C137C, C137D, C137E, C138, C141, C148, C152, C210, C211, C216, C222A, C222B, C223, C224, C232, C234, C237, C239, C240, C255A, C255B, C256, C264, D103, D104, D107, D115, D126, D138, D166, D167, D168, D173, D174, D176, D186, D207, D209A, D212A, D212B,

D213, D214, D215, D216A, D216B, D216C, D224, D225, D226, D229, D231, D233, D234, D235, D243, E102, E105, E120, E122, E123, E133, E136, E137, E140, E141, E142, E147, E153, E156, E167, E210, E214, E219A, E219B, E220, E227, E229, E231, E235, E249, E250, E256, E260, E269, E270, F108, F109, F110, F111, F113, F114, F116, F118A, F123, F129, F130, F133, F135, G102, G104, G105, G106, G112, G113, G116, G117, G118, G119, G121, G122, G123, G124, G131, G133, G137, G141, G144A, G146, G164A, G164B, G170, H100, H101, H102A, H103A, H103B, H104C, H105, H106, H108B, H109, H115B, H118, H119, H124, H125, H126, H131, H135, H141, H142, H145, H149, H156, H157, H160, H167, H172, H173, H174, H175, H207A, H208, H209, H212, H213, I102, I105, I106, I117, I118, I121A, I121B, I122, I134, I135, I136, I138, I140, I141, I142, I144, I200, I201, I202, J100, J103, J106, J109, J119, J121, J124B, J137, J144A, J144B, J147, J148, J150, J151, J153, J156B, J162, J163, J166B, J170, J202, J203

Description: Existing - Add 8204

1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Set: 30.1

Doors: G144B

Description: Existing - Add 8204 - Surface Bolt

1	Surface Bolt	580-12 @ top only	US26D	RO
1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Set: 31.0

Doors: J165, J165A

Description: Existing - Add 8204 - Armor

1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Armor Plate	K1050 36" CSK BEV	US32D	RO
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Set: 32.0

Doors: A110, A155, C119, C149, C229, C261, E211, E246, I114, I128

Description: Existing - Add 8204 - HO Closer - Custodian

1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Closer w/ HO	TB 351 H (inswing)/ PSH (outswing) As Req	EN	SA
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Set: 33.0

Doors: B103A, B104A, B110A, B113A, C101B, C102B, C104A, C105B, C109A, C109B, C110B, C114A, C115B, C125B, C127B, C129A, C130B, C135A, C136A, C139A, C140A, D209B, D230A, G140B, G140C, H137, H147B, H204B

Description: Existing - Add 8204 - HO Closer - Classroom

1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Closer w/ HO	TB 351 H (inswing)/ PSH (outswing) As Req	EN	SA
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Set: 34.0

Doors: B102A

Description: Existing - Add 8204 - Rated Classroom

1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Closer	TB 351 O/P9 (type as required)	EN	SA
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Set: 35.0

Doors: D108, D112, D113, D184, D221, D222, E106, E107, E108, E112, E114, E117, E118, E119, E121, E138, E139A, E144, E146, E148, E149B, E160A, E164A, H115A, H132B

Description: Existing - Add 8238 - Rated Classroom

1	Classroom Security Intruder Lock	V01 EMB 70 8238 VN1L 90-3/8" Collar	US26D	SA
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
1	Door Closer	TB 351 O/P9 (type as required)	EN	SA
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Set: 35.1

Doors: E139B

Description: Existing - Add 8204- Rated Classroom

1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Closer	TB 351 O/P9 (type as required)	EN	SA
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Set: 36.0

Doors: B102B, B103B, B104B, B110B, B113B, C101A, C102A, C104B, C105A, C109C, C110A, C114B, C115A, C124, C125A, C127A, C129B, C130A, C135B, C136B, C139B, C140B, C212, C213, C214, C238, D209C, D218, D240, D241A, E152A, E264, E266, E267, F103, G140A, H108A, H113, H117, H127, H132A, H133, H136, H147A, H155, H162, H201, H202, H203, H204A, H205, J149A, J149B, J154A, J166, J204, J205, J206, J207, J208, J209, J210

Description: Existing - Add 8238 - HO Closer

1 Classroom Security Intruder Lock	V01 EMB 70 8238 VN1L 90-3/8" Collar	US26D	SA
2 Interchangeable Core	I/CK-7	626	BE
2 Const. Core	7190224	Green	BE
1 Door Closer w/ HO	TB 351 H (inswing)/ PSH (outswing) As Req	EN	SA
1 Door Stop	481H	US26D	RO
1 Balance of hardware	Existing to remain		OT

Set: 37.0

Doors: C146, D105, D106, E226, J108, J127

Description: Existing - Add 8238

1 Classroom Security Intruder Lock	V01 EMB 70 8238 VN1L 90-3/8" Collar	US26D	SA
2 Interchangeable Core	I/CK-7	626	BE
2 Const. Core	7190224	Green	BE
1 Door Stop	481H	US26D	RO
1 Balance of hardware	Existing to remain		OT

Set: 38.0

Doors: F106

Description: Add Mullion

1 Mullion	KR822 (FLK as req)	600	PR
2 Stabilizer	ST989	Dull Black	PR
1 Spacer	MCS822	689	PR
1 Interchangeable Core	I/CK-7	626	BE
1 Mullion Cylinder	70 34 x 1KB-3	US32D	SA
1 Const. Core	7190224	Green	BE

Set: 39.0

Doors: A112A, A112C, A152, A153, B111, B112, C147, D110, D223, D230B, D241B, E143A, E143B, E149C, E157, E162, E163A, E163B, E165A, E228, E232, E233, E234, E265A, E265B, F107, F118B, F125, F128, G107, G108, G109, G125, G126, G127, G128, G132, G165, H104B, H107, H116, H120, H134, H137A, H139, H143, H146A, H146B, H151, H151A, H152, H158, H159, H164, H169, H170, H207B, I111, I112, I131, J124A, J124C, J133, J154B, J156A, J159, J166A

Description: Existing - Add 8237

1 Classroom Lock	70 8237 LL	US26D	SA
1 Interchangeable Core	I/CK-7	626	BE
1 Const. Core	7190224	Green	BE
1 Door Stop	481H	US26D	RO
1 Balance of hardware	Existing to remain		OT

Set: 40.0

Doors: D102, D116, D120, D122, D123, D124, D127, D128, D129, D130, D131, D132, D133, D136, D137, D139, D140, D141, D142, D152A, D152B, D152C, D154, D155, D156, D157, D158, D161, D163, D164, D165, D169, D171A, D171B, D180A, D180B, D181A, D181B, D182A, D182B, D183A, D183B

Description: Existing - Add 8205

1 Office/Entry Lock	70 8205 LL	US26D	SA
1 Interchangeable Core	I/CK-7	626	BE
1 Const. Core	7190224	Green	BE
1 Door Stop	481H	US26D	RO
1 Balance of hardware	Existing to remain		OT

Set: 41.0

Doors: D143, D159, D162, D172A, D172B, D179

Description: Existing - Add 8205/ Indicator

1	Office/Entry Lock	V01 EMB 70 8205 VN1L	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Set: 42.0

Doors: A121, C144, C145, D109, E159, H166, I113, I123, I124, I127, J158, J166C

Description: Existing - Add 8265

1	Privacy Lock	V20 8265 VN1L	US26D	SA
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Set: 43.0

Doors: C142, C143, E158, E161

Description: Existing - Add 8215

1	Passage Latch	8215 LL	US26D	SA
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Set: 44.0

Doors: F134, G168

Description: **Pr Ext - Exit Device- SN200/DT - Mullion - Closer w/Stop Arm -Access Control

1	Continuous Hinge	CFM HD1 x Dr. Ht.		PE
1	Continuous Hinge	CFM HD1 PT x Dr. Ht.		PE
2	Stabilizer	ST989	Dull Black	PR
1	Spacer	MCS822	689	PR
1	Mullion	822 (FL as req)	600	PR
1	Rim Exit x SPAR04867/NC-E11	19 LD TB 43 70 56-SN200-8804	US32D	SA
1	Rim Exit EO x SPAR#NC-E11	19 LD TB 43 8810	US32D	SA
1	Vandal Resistant Trim	826	US32D	SA
1	Vandal Resistant Trim	821	US32D	SA
2	Interchangeable Core	I/CK-7	626	BE
1	Rim Cylinder	70 34 X #90 - 1/2	US32D	SA
1	Const. Core	7190224	Green	BE
2	Kit	581-1/ 581-2 as required	EN	SA
2	Surface Closer	TB 351 PS	EN	SA
1	Gasketing	2891APK (head & jambs)		PE
1	Rain Guard	346C x Frame Width		PE
2	Sweep	345ANB x Dr. Width		PE
1	Threshold	2005AT MSES25SS X Opening Width		PE
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
2	Door Position Switch	By Security.		OT
1	Power Supply	Provided by security		SU

Notes: Operation: Doors normally closed and locked. Valid card at the card reader retracts the latch on the active leaf for entry. Free egress at all times. Door status monitored.

Set: 45.0

Doors: I129A

Description: **Pr Ext - Lock- 2N- Closer w/Stop Arm -Access Control - Peep

1	Continuous Hinge	CFM HD1 x Dr. Ht.		PE
1	Continuous Hinge	CFM HD1 PT x Dr. Ht.		PE
1	Surface Bolt	580-12 @ top only	US26D	RO
1	Fail Secure Lock	70 RX 8271 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Surface Closer	TB 351 PS	EN	SA
2	Door Stop	462	US2C	RO
1	Astragal Set (2)	18061CNB x Dr. Ht		PE
1	Gasketing	2891APK (head & jambs)		PE
1	Rain Guard	346C x Frame Width		PE
2	Sweep	345ANB x Dr. Width		PE
1	Threshold	2005AT MSES25SS X Opening Width		PE
1	ElectroLynx Harness	QC-C1500P		MK
1	ElectroLynx Harness	QC-C***P (length as req'd)		MK
2	Door Position Switch	By Security.		OT
1	Power Supply	Provided by security		SU
2	Viewer	622 x door thickness	DCRM	RO
1	Reader	By Security contractor		OT

Notes: Closer on active leaf.

Door is normally closed and secure. Presentation of valid credential allows entry by trim. Upon loss of power, door will remain secure. Free egress at all times.

Set: 46.0

Doors: I120B

Description: **Sgl - ExT -HM - Exit- SN200 FSW - Closer /Stop- Access Control

1	Continuous Hinge	CFM SLF-HD1 x Dr. Ht.		PE
1	Rim Exit x SPAR04867/NC-E11	LD 19 TB 43 70 56-SN200-8804 FSW	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Surface Closer	TB 351 PS	EN	SA
1	Door Stop	462	US2C	RO
1	Gasketing	2891APK (head & jambs)		PE
1	Rain Guard	346C x Frame Width		PE
1	Sweep	345ANB x Dr. Width		PE
1	Sweep IDF/MDF/Alum	18061CNB x Dr. Width		PE
1	Threshold	2005AT MSES25SS X Opening Width		PE
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Door Loop	DL-2		AK
1	Door Position Switch	By Security.		OT
1	Power Supply	Provided by security		SU

Notes: Operation: Doors normally closed and locked. Valid card at the card reader retracts the latch on the active leaf for entry. Free egress at all times. Door status monitored. Confirm specified hardware is compatible with door manufacturer.

Set: 47.0

Doors: J134B, J136B

Description: **Sgl - ExT -HM - Exit- SN200 FSW - Closer /Stop- Access Control - Peep

1	Continuous Hinge	CFM SLF-HD1 x Dr. Ht.		PE
1	Rim Exit x SPAR04867/NC-E11	LD 19 TB 43 70 56-SN200-8804 FSW	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Surface Closer	TB 351 PS	EN	SA
1	Door Stop	462	US2C	RO
1	Gasketing	2891APK (head & jambs)		PE
1	Rain Guard	346C x Frame Width		PE
1	Sweep	345ANB x Dr. Width		PE
1	Sweep IDF/MDF/Alum	18061CNB x Dr. Width		PE
1	Threshold	2005AT MSES25SS X Opening Width		PE
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Door Loop	DL-2		AK
1	Door Position Switch	By Security.		OT
1	Power Supply	Provided by security		SU
2	Viewer	622 x door thickness	DCRM	RO

Notes: Operation: Doors normally closed and locked. Valid card at the card reader retracts the latch on the active leaf for entry. Free egress at all times. Door status monitored. Confirm specified hardware is compatible with door manufacturer.

Set: 48.0

Doors: G163, G171B

Description: **Sgl - ExT -HM - Exit- SN200 - Closer /Stop- Access Control

1	Continuous Hinge	CFM HD1 PT x Dr. Ht.		PE
1	Electric Power Transfer	EL-CEPT	630	SU
1	Rim Exit x SPAR04867/NC-E11	19 LD TB 43 70 56-SN200-8804	US32D	SA
1	Vandal Resistant Trim	826	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Surface Closer	TB 351 PS	EN	SA
1	Gasketing	2891APK (head & jambs)		PE
1	Rain Guard	346C x Frame Width		PE
1	Sweep	345ANB x Dr. Width		PE
1	Threshold	2005AT MSES25SS X Opening Width		PE
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Door Position Switch	By Security.		OT
1	Power Supply	Provided by security		SU

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times.

Set: 49.0

Doors: G158, K101

Description: **Sgl - Ext- Mech/Storage/Fire Riser - Closer w/Stop Arm

1	Continuous Hinge	CFM HD1 x Dr. Ht.		PE
1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Surface Closer	TB 351 PS	EN	SA
1	Gasketing	2891APK (head & jambs)		PE
1	Rain Guard	346C x Frame Width		PE
1	Sweep	345ANB x Dr. Width		PE
1	Threshold	2005AT MSES25SS X Opening Width		PE
1	Door Position Switch	By Security.		OT

Set: 50.0

Doors: D150D

Description: **Pr Int- ASF - Vest SN200 Exit Device- NL/DT - Mullion - Closer /Stop - Access Control

1	Continuous Hinge	CFM SLF-HD1 x Dr. Ht.		PE
1	Continuous Hinge	CFM SLF-HD1 PT x Dr. Ht.		PE
1	Mullion	KR822 (FLK as req)	600	PR
2	Stabilizer	ST989	Dull Black	PR
1	Spacer	MCS822	689	PR
1	Rim Exit x SPAR04867/NC-E11	19 LD TB 43 70 56-SN200-8804 ETL	US32D	SA
1	Rim Exit - DT x SPAR#NC-E11	19 LD TB 43 8810 ETL	US32D	SA
2	Interchangeable Core	I/CK-7	626	BE
1	Rim Cylinder	70 34 X #90 - 1/2	US32D	SA
2	Const. Core	7190224	Green	BE
2	Kit	581-1/ 581-2 as required	EN	SA
2	Surface Closer	TB 351 PSH	EN	SA
1	Perimeter Seal	By door mfg		OT
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
2	Door Position Switch	By Security.		OT
1	Power Supply	Provided by security		SU

Notes: Operation: Doors normally closed and locked. Valid card at the card reader retracts the latch on the active leaf for entry. Free egress at all times. Door status monitored. Confirm specified hardware is compatible with aluminum door manufacturer.

Set: 51.0

Doors: D227

Description: **Pr Int- ASF - Sec CR x NL- Mullion - Closer /HO

2	Continuous Hinge	CFM SLF-HD1 x Dr. Ht.		PE
1	Mullion	KR822 (FLK as req)	600	PR
2	Stabilizer	ST989	Dull Black	PR
1	Spacer	MCS822	689	PR

1	Rim Exit 2N SPAR04867/NC-E11	LD 19 TB 43 56 70 8804 ETL	US32D	SA
1	Rim Exit Sec CR x SPAR#NC-E11	LD 19 LD 43 49 70 8816 ETL	US32D	SA
4	Interchangeable Core	I/CK-7	626	BE
1	Rim Cylinder	70 34 X #90 - 1/2	US32D	SA
4	Const. Core	7190224	Green	BE
2	Door Closer w/ HO	TB 351 H (inswing)/ PSH (outswing) As Req	EN	SA
2	Kit	581-1/ 581-2 as required	EN	SA
2	Door Stop	481H	US26D	RO
1	Perimeter Seal	By door mfg		OT

Set: 52.0

Doors: G167, I137A

Description: **Pr Ext - Storeroom/Mech- Closer/Stop - Armor

2	Continuous Hinge	CFM HD1 x Dr. Ht.		PE
1	Surface Bolt	580-12 @ top only	US26D	RO
1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
2	Surface Closer	TB 351 PS	EN	SA
2	Armor Plate	K1050 36" CSK BEV	US32D	RO
1	Astragal Set (2)	18061CNB x Dr. Ht		PE
1	Gasketing	2891APK (head & jambs)		PE
1	Rain Guard	346C x Frame Width		PE
2	Sweep	345ANB x Dr. Width		PE
1	Threshold	2005AT MSES25SS X Opening Width		PE
2	Door Position Switch	By Security.		OT

Notes: Closer on active leaf.

Set: 53.0

Doors: G154A, G156A, G161B

Description: Sgl - Exit Device-Security CL - Closer / HO

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Rim Exit Sec CR x SPAR#NC-E11	19 LD 43 49 70 8816 ETL	US32D	SA
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
1	Surface Closer	TB 351 PSH	EN	SA
1	Door Stop	481H	US26D	RO
1	Gasketing	2891APK (head & jambs)		PE

Set: 54.0

Doors: G114B, G135B, G136B, G154B, G156B

Description: Sgl - Exit Device-NL - Closer / HO - Classroom

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Rim Exit NL SPAR#NC-E11	LD 19 43 70 8804 ETL	US32D	SA
4	Interchangeable Core	I/CK-7	626	BE
4	Const. Core	7190224	Green	BE
1	Surface Closer	TB 351 PSH	EN	SA
1	Door Stop	481H	US26D	RO
1	Gasketing	2891APK (head & jambs)		PE

Set: 55.0

Doors: G111B

Description: Sgl - Rated Exit Device-NL - Closer

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Rim Exit SPAR NC-E11	12 LD 19 TB 43 70 8804 ETL	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Closer	TB 351 O/P9 (type as required)	EN	SA
1	Door Stop	481H	US26D	RO
1	Gasketing	2891APK (head & jambs)		PE

Set: 56.0

Doors: G162B

Description: **Pr - Int Classroom Sec CL x NL -Closer

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Mullion	KR822 (FLK as req)	600	PR
2	Stabilizer	ST989	Dull Black	PR
1	Spacer	MCS822	689	PR
1	Rim Exit SPAR NC-E11	LD 19 TB 43 70 8804 ETL	US32D	SA
1	Rim Exit Sec CR x SPAR#NC-E11	19 LD 43 49 70 8816 ETL	US32D	SA
4	Interchangeable Core	I/CK-7	626	BE
1	Mullion Cylinder	70 34 x 1KB-3	US32D	SA
4	Const. Core	7190224	Green	BE
1	Door Closer w/ HO	TB 351 H (inswing)/ PSH (outswing) As Req	EN	SA
2	Door Stop	481H	US26D	RO
1	Gasketing	2891APK (head & jambs)		PE
1	Mullion Gasketing	5110BL		PE

Notes:

Set: 57.0

Doors: D149A, D149B

Description: **Sgl- Int ASF- SN200 Lock- Closer - Access Control

1	Continuous Hinge	CFM SLF-HD1 PT x Dr. Ht.		PE
1	Electric Power Transfer	EL-CEPT	630	SU
1	SN200 Mort Lock	70 SN200-82271 OL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Closer	TB 351 O/P9 (type as required)	EN	SA
1	Door Stop	481H	US26D	RO
1	ElectroLynx Harness	QC-C1500P		MK
1	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Door Position Switch	By Security.		OT
1	Power Supply	Provided by security		SU
1	Gasketing	By the frame manufacturer		OT

Notes: Operation: Door normally closed and secure. Valid card at the card reader will allow entry by trim. Free egress at all times. Door status is monitored. Install reader and cylinder on reception side.

Set: 58.0

Doors: D121, G152, G157, G160

Description: **Sgl - Storeroom

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	481H	US26D	RO
3	Silencer	608		RO

Set: 59.0

Doors: G159

Description: **Sgl - Storeroom - Closer - Gasket - Sweep MDF/IDF

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Closer	TB 351 O/P9 (type as required)	EN	SA
1	Door Stop	481H	US26D	RO
1	Gasketing	2891APK (head & jambs)		PE
1	Sweep	345ANB x Dr. Width		PE
3	Silencer	608		RO

Set: 60.0

Doors: A103

Description: **Pr - Storeroom - Closer/stop - Armor

6	Hinge, Full Mortise	TA2714	US26D	MK
1	Surface Bolt	580-12 @ top only	US26D	RO
1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Surf Overhead Stop	10-x36	689	RF
1	Surface Closer	TB 351 PS	EN	SA
2	Armor Plate	K1050 36" CSK BEV	US32D	RO
1	Astragal Set (2)	18061CNB x Dr. Ht		PE
1	Gasketing	2891APK (head & jambs)		PE

Notes: Closer on active leaf.

Set: 61.0

Doors: I137B

Description: **Pr - Storeroom Lock - Rated - Armor

6	Hinge, Full Mortise	TA2714	US26D	MK
1	Continuous Latch Flush Bolt	2805 /2905	US26D	RO
1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Coordinator	2672	Black	RO
2	Mounting Bracket	2601AB	Black	RO
2	Door Closer	TB 351 O/P9 (type as required)	EN	SA

2	Door Stop	481H	US26D	RO
1	Astragal Set (2)	18061CNB x Dr. Ht		PE
1	Gasketing	2891APK (head & jambs)		PE

Set: 62.0

Doors: D148

Description: **Sgl- Int ASF- Office Lock- Closer

1	Continuous Hinge	CFM SLF-HD1 x Dr. Ht.		PE
1	Office/Entry Lock	70 8205 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Closer	TB 351 O/P9 (type as required)	EN	SA
1	Door Stop	481H	US26D	RO
1	Gasketing	By the frame manufacturer		OT

Notes:

Set: 63.0

Doors: G151, G155

Description: **Sgl - 8237

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Classroom Lock	70 8237 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	481H	US26D	RO
1	Silencer	608		RO

Set: 64.0

Doors: G166

Description: **Sgl - Classroom

4	Hinge, Full Mortise	TA2714	US26D	MK
1	Classroom Lock	70 8237 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Kit	581-1/ 581-2 as required	EN	SA
1	Door Stop	481H	US26D	RO
3	Silencer	608		RO

Set: 65.0

Doors: G114C, G114D, G114E, G153

Description: **Sgl - 8204 - STC

3	Hinges	By the STC door manufacturer		OT
1	Storeroom/Closet Lock	31 70 8204 LNL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	462	US2C	RO
1	Gasket, threshold, door bottom	By the STC door manufacturer		OT

Notes: Door hardware is specified for design intent. Confirm hardware compatibility and design meets the door manufacturer's approved assembly testing for the STC level indicated.

**31- for doors over 1 3/4" thick.

Set: 66.0

Doors: G161A

Description: Sgl - Push Pull - Closer - HO

3 Hinge (heavy weight)	T4A3786	US26D	MK	
1 Push Plate	70E	US32D	RO	
1 Pull Plate	111x70C	US32D	RO	
1 Door Closer w/ HO	TB 351 H (inswing)/ PSH (outswing) As Req	EN	SA	
1 Door Stop	481H	US26D	RO	
3 Silencer	608		RO	

Set: 67.0

Doors: G162A

Description: Pr - Push Pull - Closer - HO

6 Hinge (heavy weight)	T4A3786	US26D	MK	
2 Push Plate	70E	US32D	RO	
2 Pull Plate	111x70C	US32D	RO	
2 Door Closer w/ HO	TB 351 H (inswing)/ PSH (outswing) As Req	EN	SA	
2 Door Stop	481H	US26D	RO	
2 Silencer	608		RO	

Set: 68.0

Doors: F117, H138, H153, H154

Description: **Sgl - Multi Occ RR - Classroom Cyl - Closer

3 Hinge, Full Mortise	TA2714	US26D	MK	
1 Classroom Lock	70 10XG37 LL	US26D	SA	
1 Interchangeable Core	I/CK-7	626	BE	
1 Const. Core	7190224	Green	BE	
1 Door Closer w/ HO	TB 351 H (inswing)/ PSH (outswing) As Req	EN	SA	
1 Door Stop	481H	US26D	RO	
3 Silencer	608		RO	

Set: 69.0

Doors: J102A, J105A

Description: **Sgl - Rated Multi Occ RR - Classroom Cyl - Closer

3 Hinge, Full Mortise	TA2714	US26D	MK	
1 Classroom Lock	70 10XG37 LL	US26D	SA	
1 Interchangeable Core	I/CK-7	626	BE	
1 Const. Core	7190224	Green	BE	
1 Door Closer w/ HO	TB 351 H (inswing)/ PSH (outswing) As Req	EN	SA	
1 Door Stop	481H	US26D	RO	
1 Gasketing	2891APK (head & jambs)		PE	

Set: 70.0

Doors: C235, C236, D219, D220, D238, D239

Description: **Sgl - MS / HS Staff RR - Hotel Lock w/Indicator - Closer - Hold*

3	Hinge, Full Mortise	TA2714	US26D	MK	
1	Hotel Guest Lock Lock	V20 LC 8250 VN1L	US26D	SA	
1	Interchangeable Core	I/CK-7	626	BE	
1	Const. Core	7190224	Green	BE	
1	Mortise Cylinder for Hotel Lock	1E-7G4 C208 RP3	626	BE	
1	Door Closer w/ HO	TB 351 H (inswing)/ PSH (outswing) As Req	EN	SA	SA
1	Kit	581-1/ 581-2 as required	EN	SA	
1	Door Stop	481H	US26D	RO	
1	Silencer	608		RO	

Set: 71.0

Description: **OH Coiling Doors - No Work

1	All hardware	Existing to remain			OT
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Set: 72.0

Description: **OH Coiling Doors - Motorized

2	Mortise Cylinder	70 42	US32D	SA	
2	Interchangeable Core	I/CK-7	626	BE	
2	Const. Core	7190224	Green	BE	
2	Keyswitch	MK x MKS		SU	
1	Balance hardware	by the door manufacturer		OT	

Notes: Provide keyswitch on both sides of door.

Set: 73.0

Doors: A120A, A120B, B100B, B200, B204A, B204B, B204C, B207, B208, B209, B210A, B210B, B212, C106, C215, D114A, D117, D118, D150A, D150C, D177, D178, D185A, D208, D228, D242, E166A, E263, E268, F115A, F115B, F122A, F122B, F124B, I125, I126, J102B, J105B, J117A, J125, J134A, J136A, J152

Description: No Work

1	All hardware	Existing to remain			OT
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Set: 74.0

Doors: Attic

Description: **Attic Stock - EVERY CAMPUS

1	Hydraulic Gate Closer & Hinge	MAMMOTH-180-HD	9005	OT	
5	Quick Fix Bolts	MAMMOTH-P00006000		OT	
1	Mullion Lock	98-2520		SA	
1	Mullion Lock	98-2518		SA	
4	Classroom Security Intruder Lock	V01 EMB 70 8238 VN1L 90-3/8" Collar	US26D	SA	
50	Interchangeable Core	I/CK-7	626	BE	
20	Const. Core	7190224	Green	BE	
50	Key Blanks	Best "A" Keyway		BE	
2	Electric Strike	9400	630	HS	
2	Electric Strike	9500	630	HS	
12	Regular Hold Open Arm	25-H	EN	SA	
12	Parallel Hold Open Arm	25-PSH	EN	SA	
4	Electromagnetic Holder	994M 24VAC	689	RF	
5	994M Magnetic Parts	Door Armature 994510M	689	RF	
5	994M Magnetic Parts	Screw & Backplate 998300	689	RF	

5	994M Magnetic Parts	Swivel Armature 900-3	689	RF
5	994M Magnetic Parts	Magnet Assembly 998369-3V	689	RF
5	994M Magnetic Parts	Wall Cover 998315M	689	RF
5	Motor Assembly Kit	M56A F x SPAR05338		SA
4	SN200 Reader	52 6027 (Exit / Lock)	26D	SA

Notes: All attic stock ships direct to
 Director of Technical Services
 Cy Fair ISD Lockshop
 11430 Perry Road
 Houston, Texas 77064
 Fair.

**DO NOT ship to jobsite. Distributor to ship directly to Cy

Set: 75.0

Doors: GA-08, GA-09, J168-A, J168-B, L100, L101, L102, L103, L104, L105, L106, L107, L108-A, L108-B, L108-C, L109, L110, L111, L112, L113, L114, L115, L116-A, L116-B, L117, L118, L119, L120

Description: Not Found

1	Door	Not found		OT
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END OF SECTION 087100

**SECTION 08 8000
GLAZING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Insulated glass units.
- B. Glazing units.
- C. Glazing compounds.

1.02 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealants: Sealants for other than glazing purposes.
- B. Section 08 1113 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.
- C. Section 08 1416 - Flush Wood Doors: Glazed lites in doors.
- D. Section 08 4313 - Aluminum-Framed Storefronts: Glazing provided as part of storefront assembly.
- E. Section 08 4413 - Glazed Aluminum Curtain Walls: Glazing provided as part of wall assembly.
- F. Section 08 8300 - Mirrors.
- G. Section 08 8723 - Security Films.
- H. Section 08 8813 - Fire-Rated Glazing.
- I. Section 08 8856-Security Glazing.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- D. ASTM C1036 - Standard Specification for Flat Glass; 2021.
- E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- F. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2019.
- G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
- H. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2015.
- I. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.
- J. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.
- K. GANA (GM) - GANA Glazing Manual; 2008.
- L. GANA (SM) - GANA Sealant Manual; 2008.
- M. GANA (LGRM) - Laminated Glazing Reference Manual; 2009.
- N. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (2016).
- O. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2017.
- P. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014, with Errata (2017).

- Q. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2017.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data on Insulating Glass Unit, Glazing Unit, and Plastic Film Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Samples: Submit two samples 4 by 6 inch in size of glass units.
- E. Certificate: Certify that products of this section meet or exceed specified requirements.
- F. Manufacturer's qualification statement.
- G. Installer's qualification statement.
- H. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.
1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
 - a. Insulating Glass Certification Council (IGCC).
 - b. Safety Glazing Certification Council (SGCC).
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years documented experience and approved by manufacturer.

1.07 MOCK-UPS

- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Provide on-site glazing mock-up with the specified glazing components.
- C. Locate where directed.
- D. Mock-ups may remain as part of the Work.

1.08 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 40 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Insulating Glass Units: Provide a ten (10) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

- C. Laminated Glass: Provide a ten (10) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Glass Fabricators:
 - 1. Oldcastle BuildingEnvelope: www.obe.com.
 - 2. Viracon, Inc: www.viracon.com/#sle.
 - 3. Other Fabricators as approved by the Float Glass Manufacturer.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Float Glass Manufacturers:
 - 1. AGC Glass North America, Inc: www.agcglass.com/#sle.
 - 2. Guardian Glass, LLC: www.guardianglass.com/#sle.
 - 3. Pilkington North America Inc: www.pilkington.com/na/#sle.
 - 4. Saint Gobain North America: www.saint-gobain.com/#sle.
 - 5. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
 - 1. Design Pressure: Calculated in accordance with applicable codes.
 - 2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
 - 3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
 - 4. Glass thicknesses listed are minimum. Deflection shall be no greater than the thickness of the glass. Final glazing thickness shall comply with all specification reference standards and glazing manufacturer recommendations for span width and height of each installation.
- B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
- C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
 - 1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 - 2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 - 3. Solar Optical Properties: Comply with NFRC 300 test method.
- D. Fully Tempered Safety Glass: Shall meet impact resistance per ANSI Z97.1 - Class A, or 16 CFR 1201 - Category II criteria for safety glazing used in hazardous locations.

2.03 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
 - 1. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
 - 2. Fully Tempered Safety Glass: Shall meet impact resistance per ANSI Z97.1 - Class A, or 16 CFR 1201 - Category II criteria for safety glazing used in hazardous locations.
 - 3. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality - Q3, with color and performance characteristics as indicated.

4. Thicknesses: Glass thicknesses listed are minimum. Deflection shall be no greater than the thickness of the glass. Final glazing thickness shall comply with all specification reference standards and glazing manufacturer recommendations for span width and height of each installation.
- B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class A or 16 CFR 1201 - Category II impact test requirements.
 2. Polyvinyl Butyral (PVB) Interlayer: 0.030 inch thick, minimum.

2.04 INSULATED GLASS UNITS

- A. Manufacturers:
1. Glass: Any of the manufacturers specified for float glass, unless specifically required by manufacturer's tested assembly.
- B. Fabricator: Certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.
- C. Insulated Glass Units: Types as indicated.
1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
 2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
 3. Metal-Edge Spacers: Aluminum, bent and soldered corners.
 4. Spacer Color: Aluminum.
 5. Edge Seal:
 - a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone sealant as secondary seal applied around perimeter.
 - b. Color: Black.
 6. Space between lites filled with air.
 7. Purge interpane space with dry air, hermetically sealed.
 8. Capillary Tubes: Provide tubes from air space for insulating glass units without inert type gas that have a change of altitude greater than 2500 feet between point of fabrication and point of installation to permit pressure equalization of air space.
 - a. Capillary Tubes: Tubes to remain open and be of length and material type in accordance with insulating glass fabricator's requirements.
- D. Type IGU - Insulated Glass Units:
1. Applications: Exterior glazing unless otherwise indicated.
 2. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
 - a. Tint: Light Gray Appearance.
 - b. Coating: Low-E (passive type), on #2 surface.
 3. Metal edge spacer.
 4. Inboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
 - a. Tint: Clear.
 5. Total Thickness: 1 inch.
 6. Thermal Transmittance (U-Value), Summer - Center of Glass: 0.29, maximum.
 7. Visible Light Transmittance (VLT): 36 percent, nominal.
 8. Solar Heat Gain Coefficient (SHGC): 0.23, maximum.
 9. Visible Light Reflectance, Outside: 13 percent, maximum.
 10. Glazing Method: Dry glazing method, gasket glazing.
- E. Type IGSEF - Insulated Glass with applied SEcurity Film
1. Applications: Where indicated on the drawings.
 2. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
-

- a. Tint: Light Gray Appearance.
 - b. Coating: Low-E (passive type), on #2 surface.
 3. Inboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
 - a. Tint: Clear.
 - b. Provide Security Film as specified in 08 8723-Security Films.
 - c. Apply Security Film on #1 and #4 surface.
 4. Total Thickness: 1 inch.
 5. Thermal Transmittance (U-Value), Summer - Center of Glass: 0.29, maximum.
 6. Visible Light Transmittance (VLT): 36 percent, minimum.
 7. Solar Heat Gain Coefficient (SHGC): 0.23, maximum.
 8. Visible Light Reflectance, Outside: 13 percent, maximum.
 9. Impact Resistance: Complies with ANSI Z97.1 - Class A and 16 CFR 1201 - Category II impact test requirements.
 10. Wet Glaze Anchoring System: Structural Silicone Sealant/Adhesive.
 - a. Dow Chemical Company; Dowsil 995 Silicone Structural Sealant: www.dow.com.
- F. Type IGS - Insulated Glass Spandrel:
1. Applications: Exterior spandrel glazing unless otherwise indicated.
 2. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
 - a. Tint: Light Gray Appearance.
 - b. Coating: Same as Type IGU, on #2 surface.
 3. Metal edge spacer.
 4. Inboard Lite: Fully tempered float glass, 1/4 inch thick.
 - a. Tint: Clear.
 - b. Opacifier: Ceramic frit, on #4 surface.
 - c. Opacifier Color: Match Type IGU.
 5. Total Thickness: 1 inch.
 6. Glazing Method: Dry glazing method, gasket glazing.

2.05 GLAZING UNITS

- A. Type GTC - Glass Tempered Clear:
1. Applications: Interior glazing unless otherwise indicated.
 2. Glass Type: Fully tempered float glass.
 3. Tint: Clear.
 4. Thickness: 1/4 inch, minimum.

2.06 GLAZING COMPOUNDS

- A. Butyl Sealant: Single component; ASTM C920 Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.
- B. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; nonbleeding, nonstaining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.
- C. Silicone Structural Sealant: Single component; neutral curing; designed specifically for structural bonding applications of glass; ASTM C920 Type S, Grade NS, Class 50, Uses NT, A, and G; with cured Shore A hardness range of 40; color as selected.
1. Basis of Design: Dow Chemical Company; Dowsil 995 Silicone Structural Sealant: www.dow.com.

2.07 ACCESSORIES

- A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.

- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness. Minimum 3 inch long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.
- C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
- D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; color black.
- E. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that the minimum required face and edge clearances are being provided.
- C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
- D. Verify that sealing between joints of glass framing members has been completed effectively.
- E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, and paint.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

- A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

- D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 CLEANING

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove nonpermanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.06 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

**SECTION 08 8723
SECURITY FILMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glazing film applied to existing and new glazing assemblies.
- B. All film and anchoring shall be field installed by qualified and certified applicators.

1.02 RELATED REQUIREMENTS

- A. Section 08 1113 - Hollow Metal Doors and Frames: New doors with glazing to receive film.
- B. Section 08 4313-Aluminum-Framed Storefronts: New glazing to receive film.
- C. Section 08 4413 - Glazed Aluminum Curtain Walls: New glazing to receive film.
- D. Section 08 8000 - Glazing: New glazing to received film.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- D. ASTM C1184 - Standard Specification for Structural Silicone Sealants; 2014.
- E. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting; 2012.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- G. FTD-SA - Filti Testing and Development Shooter Attack Certification.; Current Edition.
- H. UL 972 - Standard for Burglary Resisting Glazing Material; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Record of product certification for safety requirements.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods.
- C. Shop Drawings: Detailing installation of film, anchoring accessories, and sealant.
- D. Samples: For each film product to be used, minimum size 4 inches by 6 inches, representing actual product, color, and patterns.
- E. Samples, Supplemental Anchors: Where supplemental anchors are necessary to achieve specified performance submit detailed information in accordance with substitution procedures; include two samples, minimum length 2 inches.
- F. Test Reports: Detailed reports of full-scale chamber tests to specified criteria, using assemblies identical to those required for this project.
- G. Specimen Warranty.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Glazing film manufacturer specializing in manufacture of safety glazing films with minimum 10 years successful experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of authorities having jurisdiction.

1.07 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide 15 year manufacturer's replacement warranty to cover film against peeling, cracking, discoloration, and deterioration.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Armoured One: www.armouredone.com/#sle.
- B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SECURITY FILM

- A. Security Film: Transparent polyester security film for permanent bonding to glass.
 - 1. Basis of Design: Armoured One, LLC, AOTSF23 Security Film for permanent bonding to glass.
 - 2. Application: Locations as indicated on drawings.
 - 3. Surface Burning Characteristics: Flame Spread Index (FSI)/Smoke Developed Index (SDI) of Class A, 25/450, maximum, when tested in accordance with ASTM E84.
 - 4. Tensile Strength: Minimum of 35,000 psi when measured in accordance with ASTM D882.
 - 5. Breaking Strength: ASTM D-882, 640 lbs. / inch
 - 6. Elongation at Break: ASTM D-882, 230%
 - 7. Comply with ANSI Z97.1, Class A and 16 CFR 1201, Category II impact test requirements.
 - 8. Forced Entry Resistance; Must comply with the following multiple impact test:
 - a. FTD-SA - Filti Testing and Development Shooter Attack Certification Class 1.
 - b. UL 972 tests in compliance with level of burglary and forced-entry resistance indicated; Multiple Impact.
 - 9. Color: Clear.
 - 10. Thickness: 0.023 inch.
 - a. Installing multiple layers of thinner film to accomplish the required thickness is not allowed.
 - 11. Anchoring System: Provide silicone structural sealant attachment system installed per manufacturers recommendations.
- B. Accessory Materials: As recommended or required by film manufacturer.
- C. Supplementary Anchors: As required by performance criteria and acceptable to Architect.
- D. Silicone Structural Sealant: Self-priming, elastomeric adhesive complying with ASTM C1184.
 - 1. Silicone Structural Sealant: Single component; neutral curing; designed specifically for structural bonding applications of glass; ASTM C920 Type S, Grade NS, Class 50, Uses NT, A, and G; with cured Shore A hardness of 40; color as selected.
 - 2. Basis of Design: Dow Chemical Company; Dowsil 995 Silicone Structural Sealant: www.dow.com.

- E. Glass Cleaner: As recommended by glazing film manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Field -Applied Film: Verify that existing conditions are adequate for proper application and performance of film.
- B. Examine glass and frames. Verify that existing conditions are adequate for proper application and performance of film.
- C. Verify glass is not cracked, chipped, broken, or damaged.
- D. Verify that frames are securely anchored and free of defects.
- E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean glass of dust, dirt, paint, oil, grease, mildew, mold, and other contaminants that would inhibit adhesion.
- B. Immediately prior to applying film, thoroughly wash glass with neutral cleaning solution.
- C. Protect adjacent surfaces.
- D. Do not begin installation until substrates have been properly prepared.

3.03 INSTALLATION

- A. Do not apply glazing film when surface temperature is less than 40 degrees F or if precipitation is imminent.
- B. Install in accordance with manufacturer's instructions, without air bubbles, wrinkles, streaks, bands, thin spots, pinholes, or gaps, as required to achieve specified performance.
- C. Seams: Seam film only as required to accommodate material sizes; form seams vertically without overlaps and gaps; do not install with horizontal seams.
- D. Structural Sealant and Supplemental Anchors: Install in accordance with manufacturer's instructions and shop drawings.
- E. Clean glass and anchoring accessories following installation. Remove excess sealants and other glazing materials from adjacent finished surfaces.
- F. Remove labels and protective covers.

3.04 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

**SECTION 08 8813
FIRE-RATED GLAZING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire-rated glazing units.
- B. Glazing compounds.

1.02 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealants: Sealants for other than glazing purposes.
- B. Section 08 1213 - Hollow Metal Frames: Glazed borrowed lites.
- C. Section 08 1416 - Flush Wood Doors: Glazed lites in doors.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2015).
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
- E. GANA (GM) - GANA Glazing Manual; 2008.
- F. GANA (SM) - GANA Sealant Manual; 2008.
- G. GANA (LGRM) - Laminated Glazing Reference Manual; 2009.
- H. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (2016).
- J. ITS (DIR) - Directory of Listed Products; current edition.
- K. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2017.
- L. NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies; 2017.
- M. UL (DIR) - Online Certifications Directory; Current Edition.
- N. UL 9 - Standard for Fire Tests of Window Assemblies; Current Edition, Including All Revisions.
- O. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- P. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene preinstallation meeting one week before starting work of this section; require attendance by each of affected installers.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data on Glazing Unit Glazing Types: Provide structural, physical, and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Samples: Two samples 4 by 6 inch in size of glass units.

- E. Certificate: Certify that products of this section meet or exceed specified requirements.
- F. Manufacturer's qualification statement.
- G. Installer's qualification statement.
- H. Specimen warranty.

1.06 QUALITY ASSURANCE

- A. Perform work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
 - 1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
 - a. Insulating Glass Certification Council (IGCC).
 - b. Safety Glazing Certification Council (SGCC).
- C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.07 MOCK-UPS

- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Provide on-site glazing mock-up with specified glazing components.
- C. Locate where directed.
- D. Mock-ups may remain as part of work.

1.08 FIELD CONDITIONS

- A. Ambient Conditions: Do not install glazing when ambient temperature is less than 40 degrees F.
- B. Maintain minimum ambient temperature before, during, and 24 hours after installation of glazing compounds.

1.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire-Protection-Rated Glass:
 - 1. Fabricators:
 - a. GGI - General Glass International: www.generalglass.com/#sle.
 - b. McGrory Glass, Inc: www.mcgrory.com/glass/fire-rated-glass-schott-pyran-platinum/#sle.
 - 2. Manufacturers:
 - a. McGrory Glass, Inc: www.mcgrory.com/fire-rated-glass/#sle.
 - b. SAFTIFIRST, a division of O'Keeffe's Inc: www.safti.com/#sle.
 - c. SCHOTT North America Inc: www.us.schott.com/#sle.
 - d. Technical Glass Products: www.fireglass.com/#sle.
 - e. Vetrotech North America: www.vetrotechusa.com/#sle.
 - f. Substitutions: See Section 01 6000 - Product Requirements.

2.02 GLAZING UNITS

- A. Type GFPR - Glass Fire-Protection-Rated: Type, thickness, and configuration of glazing that contains flame, smoke, and does not block radiant heat, as required to achieve indicated fire rating period as indicated on drawings.
1. Applications:
 - a. Glazing in fire-protection-rated door assembly.
 - b. Glazing in fire-protection-rated window assembly.
 - c. Other locations as indicated on drawings.
 2. Provide products listed by ITS (DIR) or UL (DIR) and approved by authorities having jurisdiction.
 3. Safety Glazing Certification: 16 CFR 1201 Category II.
 4. Glazing Method: As required for fire rating.
 5. Fire-Rating Period: As indicated on drawings.
 6. Markings for Fire-Protection-Rated Glazing Assemblies: Provide permanent markings on fire-protection-rated glazing in compliance with ICC (IBC), local building code, and authorities having jurisdiction
 - a. "D" - meets fire door assembly criteria of NFPA 252, UL 10B, or UL 10C fire test standards.
 - b. "OH" - meets fire window assembly criteria, including hose stream test of NFPA 257 or UL 9 fire test standards.
 - c. "H" - meets fire door assembly hose stream test of NFPA 252, UL 10B, or UL 10C fire tests standards.
 - d. "XXX" - placeholder that represents fire-rating period, in minutes.

2.03 GLAZING COMPOUNDS

- A. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; nonbleeding, nonstaining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

2.04 ACCESSORIES

- A. Setting Blocks: Neoprene, EPDM, or silicone, with 70 to 90 Shore A durometer hardness. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Continuous by one half the height of glazing stop by thickness to suit application, self adhesive on one face.
- C. Glazing Tape: Closed-cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to affect air barrier and vapor retarder seal.
- D. Glazing Gaskets: Flexible intumescent seals.
 1. Material: Co-extruded intercalated graphite combined with thermoplastic lip.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that minimum required face and edge clearances are provided.
- C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
- D. Verify that sealing between joints of glass framing members has been completed effectively.
-

- E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION - GENERAL

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers unless more stringent requirements are indicated, including those in referenced glazing standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- F. Prevent glass from contact with contaminating substances that may result from construction operations including, but not limited to weld spatter, fire-safing, plastering, mortar droppings, etc.

3.04 CLEANING

- A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.
- B. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- C. Remove nonpermanent labels immediately after glazing installation is complete.
- D. Clean glass and adjacent surfaces after sealants are fully cured.
- E. Clean glass on both exposed surfaces not more than four days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.05 PROTECTION

- A. After installation, mark pane with 'X' by using removable plastic tape or paste; do not mark heat-absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

**SECTION 08 8856
SECURITY GLAZING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glass Units: Laminated Security.

1.02 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealants: Sealants for other than glazing purposes.
- B. Section 08 1113 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.
- C. Section 08 1416 - Flush Wood Doors: Glazed lites in doors.
- D. Section 08 4313 - Aluminum-Framed Storefronts: Glazing provided as part of storefront assembly.
- E. Section 08 4413 - Glazed Aluminum Curtain Walls: Glazing provided as part of wall assembly.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).
- C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2015).
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- F. ASTM C1036 - Standard Specification for Flat Glass; 2021.
- G. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- H. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2019.
- I. ASTM C1184 - Standard Specification for Structural Silicone Sealants; 2014.
- J. ASTM F1233 - Standard Test Method for Security Glazing Materials And Systems; 2008 (Reapproved 2019).
- K. GANA (GM) - GANA Glazing Manual; 2008.
- L. GANA (SM) - GANA Sealant Manual; 2008.
- M. GANA (LGRM) - Laminated Glazing Reference Manual; 2009.
- N. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- O. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (2016).
- P. NFRC 300 - Standard Test Method for Measurement of Masonry Flexural Bond Strength; 2013, with Editorial Revision (2014).
- Q. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Samples: Submit two samples 4 by 6 inch in size of glass units.
- E. Certificate: Certify that products of this section meet or exceed specified requirements.
- F. Manufacturer's qualification statement.
- G. Installer's qualification statement.
- H. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.
 - 1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
 - a. Insulating Glass Certification Council (IGCC).
 - b. Safety Glazing Certification Council (SGCC).
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years documented experience and approved by manufacturer.

1.07 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 40 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.
- C. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.
- D. Polycarbonate Sheet Glazing: Provide a five (5) year manufacturer warranty to include coverage for breakage, coating failure, abrasion resistance, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Laminated Security Glass Manufacturers:
 - 1. Global Security Glazing: www.security-glazing.com.
 - 2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
 - 1. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
 - 2. Fully Tempered Glass: Complies with ANSI Z97.1 - Class A, or 16 CFR 1201 - Category II criteria.
 - 3. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality - Q3, with color and performance characteristics as indicated.
 - 4. Thicknesses: Glass thicknesses listed are minimum. Deflection shall be no greater than the thickness of the glass. Final glazing thickness shall comply with all specification reference standards and glazing manufacturer recommendations for span width and height of each installation.
- B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
 - 1. Laminated Glass: Complies with ANSI Z97.1 - Class A or 16 CFR 1201 - Category II impact test requirements.
 - 2. Forced Entry Resistance: See glazing types for specific requirements for each assembly.

2.03 GLASS UNITS

- A. Type GLSE - Glass Laminated SEcurity.
 - 1. Basis of Design: Childgard-2118 Security Glazing.
 - 2. Applications: Locations as indicated on drawings.
 - 3. Tint: Clear.
 - 4. Thickness: 1/2 inch (nominal).
 - 5. Outer Lite: Fully Tempered glass.
 - 6. Interlayer: Manufactures custom security interlayer , thickness as required to meet performance criteria.
 - 7. Inside Lite: Fully Tempered glass.
 - 8. Forced Entry Resistance; Must comply with one of the following multiple impact test:
 - a. ASTM F1233 Standard Test Method for Security Glazing Materials and Systems, Class 1.4.
 - 9. Wet Glaze Anchoring System: Structural Silicone Sealant/Adhesive.
 - a. Dow Chemical Company; Dowsil 995 Silicone Structural Sealant: www.dow.com.

2.04 ACCESSORIES

- A. Silicone Structural Sealant: Self-priming, elastomeric adhesive complying with ASTM C1184.
 - 1. Silicone Structural Sealant: Single component; neutral curing; designed specifically for structural bonding applications of glass; ASTM C920 Type S, Grade NS, Class 50, Uses NT, A, and G; with cured Shore A hardness of 40; color as selected.
 - 2. Basis of Design: Dow Chemical Company; Dowsil 995 Silicone Structural Sealant: www.dow.com.
- B. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.
- C. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.
- D. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
- E. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color as selected.

- F. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that the minimum required face and edge clearances are being provided.
- C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
- D. Verify that sealing between joints of glass framing members has been completed effectively.
- E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- F. Structural Sealant and Supplemental Anchors: Install in accordance with manufacturer's instructions and shop drawings.
- G. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.04 CLEANING

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove nonpermanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.05 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

**SECTION 09 2116
GYPSUM BOARD ASSEMBLIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Exterior gypsum sheathing.
- C. Gypsum wallboard.
- D. Joint treatment and accessories.
- E. Textured finish system.

1.02 RELATED REQUIREMENTS

- A. Section 05 4000 - Cold-Formed Metal Framing: Structural steel stud framing.
- B. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.
- C. Section 07 2100 - Thermal Insulation: Acoustic insulation.
- D. Section 07 2500 - Weather Barriers: Water-resistive barrier over sheathing.
- E. Section 07 8400 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.
- F. Section 07 9200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.03 REFERENCE STANDARDS

- A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017.
- B. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
- C. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2020.
- D. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2022.
- E. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2018.
- F. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2020.
- G. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2019.
- H. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.
- I. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2018.
- J. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing; 2018.
- K. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
- L. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2016.
- M. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
- N. ASTM E413 - Classification for Rating Sound Insulation; 2016.

- O. GA-214 - Levels of Finish for Gypsum Panel Products; 2021.
- P. GA-216 - Application and Finishing of Gypsum Panel Products; 2016.
- Q. GA-226 - Application of Gypsum Board to Form Curved Surfaces; 2019.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
- C. Product Data: Provide data on gypsum board, glass mat faced gypsum board, accessories, and joint finishing system.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum five years of experience.
- B. Product Qualifications:
 - 1. Single Source Responsibility:
 - a. Obtain gypsum board products, joint treatment products, and textured coatings from a single manufacturer.
- C. Mock-ups
 - 1. At an area on the site where approved by the Architect, provide a mock-up gypsum wallboard panel.
 - a. Make the panel approximately 4'-0" square.
 - b. Provide one mock-up panel for each gypsum wallboard finish used on the Work.
 - c. For exterior gypsum sheathing, panel shall be complete with all joint sealant, wall ties and/or connectors, flashings and face veneer.
 - d. The mock-ups may be used as part of the Work, and may be included in the finished Work, when so approved by the Architect.
 - e. Revise as necessary to secure the Architect's approval.
 - 2. The mock-up panels, when approved by the Architect, will be used as datum points for comparison with the remainder of the work of this Section for the purpose of acceptance or rejection.
- D. Reference Standards:
 - 1. Install gypsum board in accordance with applicable requirements and recommendations of Gypsum Association GA 216, "Recommended Specifications for the Application and Finishing of Gypsum Board", except for more stringent requirements of manufacturer.
 - 2. Apply acoustical sealant in accordance with applicable requirements of ASTM C919.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of Section 01 6000 – Product Requirements.
- B. Acceptance at Site
 - 1. Deliver material to site promptly without undue exposure to weather.
 - 2. Deliver in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade.
- C. Storage and Protection
 - 1. Protect materials from contamination, dampness, freezing, or overheating in accordance with manufacturer's instructions.
 - 2. Store above ground in dry, ventilated space.
 - 3. Broken, or damaged gypsum board will be rejected, whether built-in or not.

1.07 PROJECT CONDITIONS

- A. Project Environmental Requirements

1. Comply with requirements of referenced standards and recommendations of material manufacturers for environmental conditions before, during, and after installation.
2. Do not begin installation of gypsum board until building is completely enclosed and protected from water infiltration.
3. Do not install gypsum board when ambient temperature is below 40°F.
4. For adhesive attachment of gypsum board, and for finishing of gypsum board, maintain ambient temperature above 55°F from one week prior to attachment or joint treatment, and until joint treatment is complete and dry.
5. Maintain illumination as required for proper installation of material.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
 1. See PART 3 for finishing requirements.
- B. Interior Partitions: Provide completed assemblies with the following characteristics:
 1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- C. Fire-Resistance-Rated Assemblies: Provide completed assemblies complying with applicable code.

2.02 METAL FRAMING MATERIALS

- A. Structural and Non-Structural Steel Framing for Application of Gypsum Board: As specified in Section 05 4000.

2.03 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
 1. CertainTeed Corporation: www.certainteed.com/#sle.
 2. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
 3. National Gypsum Company: www.nationalgypsum.com/#sle.
 4. USG Corporation: www.usg.com/#sle.
 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 1. Application:
 - a. Non-fire rated partitions and ceilings: Type X.
 - b. Fire rated partitions: Type X.
 - c. Fire rated ceilings: Type C.
 2. Thickness:
 - a. Vertical Surfaces: 5/8 inch.
 - b. Ceilings: 5/8 inch.
 - c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
 3. Paper-Faced Products:
 - a. CertainTeed Corporation; Type X and C Drywall: www.certainteed.com/#sle.
 - b. Georgia-Pacific Gypsum; ToughRock Fireguard X and C: www.gpgypsum.com/#sle.
 - c. National Gypsum Company; Gold Bond BRAND Fire-Shield Type X and C Gypsum Board: www.nationalgypsum.com/#sle.
 - d. USG Corporation; USG Sheetrock Brand Firecode X and C Panels: www.usg.com/#sle.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
- C. Backing Board For Wet Areas:

1. Application: Surfaces behind tile and in wet areas including tub and shower surrounds, shower ceilings, and typical wall drywall base as detailed on the drawings.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 3. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
 - a. Fire-Resistance-Rated Type: Type X core, thickness 5/8 inch.
 - b. Products:
 - 1) CertainTeed Corporation; GlasRoc 5/8" Type X Tile Backer: www.certainteed.com/#sle.
 - 2) Georgia-Pacific Gypsum; DensShield Tile Backer: www.gpgypsum.com/#sle.
 - 3) National Gypsum Company; Gold Bond eXP Tile Backer: www.nationalgypsum.com/#sle.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.
- D. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
1. Application: Exterior sheathing, unless otherwise indicated.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 3. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
 4. Core Type: Type X, as indicated.
 5. Type X Thickness: 5/8 inch.
 6. Edges: Square.
 7. Glass Mat Faced Products:
 - a. CertainTeed Corporation; GlasRoc Type X Exterior Sheathing: www.certainteed.com/#sle.
 - b. Georgia-Pacific Gypsum; DensGlass Fireguard Sheathing: www.gpgypsum.com/#sle.
 - c. National Gypsum Company; Gold Bond eXP Sheathing: www.nationalgypsum.com/#sle.
 - d. USG Corporation; USG Securock Brand Ultralight Glass-Mat Sheathing Firecode X: www.usg.com/#sle.
 - e. Substitutions: See Section 01 6000 - Product Requirements.

2.04 GYPSUM WALLBOARD ACCESSORIES

- A. Acoustic Insulation: As specified in Section 07 2100.
 - B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
 - C. Water-Resistive Barrier: As specified in Section 07 2500.
 - D. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
 1. Corner Beads: Low profile, for 90 degree outside corners.
 2. Splayed Corner Beads: All other than 90 degree outside corner.
 3. Architectural Reveal Beads:
 - a. Shapes: As indicated on drawings.
 4. Expansion Joints:
 - a. Type: V-shaped metal with factory-installed protective tape.
 5. Adjustable Partition Closure between storefront and drywall: Gordon Interior Specialties; Mullion Mate. Provide insulation and gaskets. Size to match application. Finish to match storefront.
 6. Other trims and reveals where shown on the drawings.
 - E. Moisture Guard Trim: ASTM C1047, rigid plastic, 48 inch length, applied to bottom edge of gypsum board.
-

1. Provide 1/2" Tall Extruded PVC Moisture Guard: installed continuously at floor level of all gypsum drywall throughout building.
 2. On all 2-Hour Rated walls and once the wall assembly is constructed, place a bead of sealant (latex, acrylic, silicone, polymer, or similar materials – not necessarily listed “fire caulk”) at floor level against the outer most layer of moisture guard on each side of the wall.
 3. Height: 1/2 inch.
 4. Depth: 5/8 inch.
 5. Products:
 - a. Waterguard USA; Waterguard: www.waterguard-usa.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- F. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
1. Fiberglass Tape: 2 inch wide, coated glass fiber tape for joints and corners at glass mat faced board assemblies.
 2. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
 3. Joint Compound: Drying type, ready-mixed.
- G. Finishing Compound: Surface coat and primer, takes the place of skim coating.
- H. Textured Finish Materials: Latex- or Vinyl-based compound; plain.
- I. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.
- J. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.
- K. For exterior applications provide bugle or wafer head, rust-resistant sharp point, fine thread for light-gauge metal framing or furring.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C754 and as specified in Section 05 4000-Cold-Formed Metal Framing.
- B. Blocking: Install supplementary framing, blocking and bracing for support of:
1. Framed openings.
 2. Wall-mounted cabinets.
 3. Plumbing fixtures.
 4. Toilet partitions.
 5. Toilet accessories.
 6. Wall-mounted door hardware.
 7. Heavy trim, furnishings or similar construction.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
1. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.04 BOARD INSTALLATION - GENERAL

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Wall Tile shall be installed on Concrete Unit Masonry or Glass Mat Faced Tile Backer Board in toilet/shower rooms, around water fountains or other areas in which the tile might be exposed to moisture. If CMU is not provided in these areas, Glass Mat Faced Tile Backer Board shall be used. Wall tile to be installed on Glass Mat Faced Tile Backer Board where located in corridors.
- C. FRP shall be installed on Glass Mat Faced Tile Backer Board in toilet rooms, janitor closets, around water fountains or other areas in which the tile might be exposed to moisture.
- D. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- E. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
- F. Exterior Sheathing: Comply with GA-253 and ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
 - 1. Seal joints, cut edges, and holes with water-resistant sealant.
 - 2. Attach exterior sheathing to metal framing with screws spaced 8" o.c. at perimeter where there are framing supports; and 8" o.c. along intermediate framing in field. Do not counter sink.
 - 3. Locate fasteners minimum 3/8" from edges and ends of sheathing panels, tight against and flush with surface of sheathing.
 - 4. Immediately after installation, protect from weather by application of water-resistive barrier.
- G. Installation on Metal Framing: Use screws for attachment of gypsum board.
- H. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

3.05 BOARD INSTALLATION

- A. Single Layer Gypsum Board on Metal Studs or ICF System.
 - 1. Loosely butt gypsum board joints together and neatly fit.
 - 2. Do not place butt ends against tapered edges.
 - 3. Maximum allowable gap at end joints: 1/8 inch.
 - 4. Stagger joints on opposite sides of partitions.
 - 5. Apply ceiling boards first where gypsum board ceilings and wall occur.
 - 6. Cut openings in gypsum board to fit electrical outlets, plumbing, light fixtures and piping snugly and small enough to be covered by plates and escutcheons. Cut both face and back paper.
 - 7. Screw board in place securely with screws spaced according to manufacturer's recommendations.
 - 8. At internal and external corners, conceal the cut edges of the boards by the overlapping covered edges of the abutting boards.
 - 9. Stagger the boards so that corners of any four boards will not meet at a common point except in vertical corners.
 - 10. At internal and external corners, conceal the cut edges of the boards by the overlapping covered edges of the abutting boards.
 - 11. In all installations, gypsum wallboard shall be held above the finished floor a minimum of 1/2". Failure to comply with this requirement will be grounds for rejection and removal of the entire application.
- B. Single Layer Gypsum Board on Furring
 - 1. Apply gypsum board with long dimension at right angles to furring channel.

2. Center end joints over channel web; stagger end joints from those in adjacent rows of board.
 3. Fasten boards to furring channels with screws spaced according to manufacturer's recommendations.
- C. Double Layer Gypsum Board
1. Fasten base layer to studs or furring with screws, and attach face layer using laminating adhesive and screws, applied according to manufacturer's instructions.
 2. Offset face-layer joints at least 10 inches from parallel base-layer joints.
 3. Screw both layers to metal supports at double layer ceiling applications and where required for fire-rated construction.
- D. Single Layer Gypsum Board Suspended for Ceilings:
1. Install the gypsum wallboard to ceilings with the long dimension of the wallboard at right angles to the supporting members.
 2. Wallboard may be installed with the long dimension parallel to supporting members that are spaced 16" on centers when attachment members are provided at end joints.

3.06 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints
1. Install control joints at junction of gypsum board partitions with walls or partitions of other finish material.
 2. Install control joints within long runs of partitions at approximately 30'-0" on center or as indicated on the drawing.
 3. Install control joints at bulkheads as shown on the drawings but in no case shall they exceed 15'-0" on center or as indicated on the drawing. Contractor shall be responsible to insure that bulkheads comply with this requirement and shall coordinate locations with the architect if not shown on the drawings.
 4. Where gypsum board is vertically continuous, as at stairwells, provide horizontal control joints at each floor level.
 5. Special Trim: Install as indicated on Drawings and in accordance with manufacturer's instructions.
 6. Install control joints at each door jamb from head of door ceiling as shown on the drawings.
 7. Do not install control joints behind any applied wall coverings.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.
- D. Install metal casing bead trim whenever edge of gypsum board would otherwise be exposed or semi-exposed.
- E. Special Trim and Reveal Joints: Install as indicated on Drawings and in accordance with manufacturer's instructions.
- F. Moisture Guard Trim: Install on bottom edge of gypsum board according to manufacturer's instructions and in locations indicated on drawings.

3.07 JOINT TREATMENT

- A. Finish gypsum board in accordance with levels defined in GA-214 , ASTM C840, and as follows:
1. Level 1: Ceiling plenum areas and concealed areas, except provide higher level of finish as required to comply with fire resistance ratings and acoustical ratings.
 2. Level 2: Gypsum board substrate at tile, except remove tool marks and ridges.
 3. Level 3: Gypsum board surfaces, where textured finishes will be used.

4. Level 4: Gypsum board surfaces scheduled to receive non-textured painted finishes, vinyl wall covering or custom covering is to be applied, except where another finish level is indicated.
 5. Level 5: Gypsum board surfaces scheduled to receive painted graphics or Dry-Erase Coating.
- B. General:
1. Inspect areas to be joint treated, verifying that the gypsum wallboard fits snugly against supporting framework.
 2. In areas where joint treatment and compound finishing will be performed, maintain a temperature of not less than 55 degrees for 24 hours prior to commencing the treatment, and until joint and finishing compounds have dried.
 3. Apply the joint treatment and finishing compound by machine or hand tool.
 4. Provide a minimum drying time of 24 hours between coats, with additional drying time in poorly ventilated areas.
 5. Joint Treatment is required at all gypsum board walls including fire protection assemblies and ICF installations above the ceiling line.
- C. Embedding compounds:
1. Apply to gypsum wallboard joints and fastener heads in a thin uniform layer.
 2. Spread the compound not less than 3" wide at joints, center the reinforcing tape in the joint, and embed the tape in the compound. Then spread a thin layer of compound over the tape.
 3. After this treatment has dried, apply a second coat of embedding compound to joints and fastener heads, spreading in a thin uniform coat to not less than 6" wide at joints, and feather edged.
 4. Sandpaper between coats as required.
 5. When thoroughly dry, sandpaper to eliminate ridges and high points.

3.08 TEXTURE FINISH

- A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions.
- B. Texture Required: Unless shown or otherwise indicated on the drawings, provide medium "Orange Peel or Spatter Finish" texture on walls or ceilings.

3.09 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

**SECTION 09 2226
SUSPENSION SYSTEMS**

PART 1 - GENERAL

1.01 SUMMARY

- A. Related Documents: General and Supplementary Conditions of the Contract, Division 1 General Requirements, and Drawings are applicable to this Section.
- B. Section Includes, but is not limited to:
 - 1. Metal suspension systems.
 - 2. Trim and accessories.
- C. Related Sections:
 - 1. Section 05 4000 – Cold-Formed Metal Framing
 - 2. Section 09 2982 – Gypsum Board
 - 3. Section 09 5100 – Acoustical Ceilings
 - 4. Section 09 9000 – Painting and Coating

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. A635 - Standard Specification for Sheet Steel.
 - 2. A641 - Standard Specification for Zinc-Coated Carbon Steel Wire
 - 3. C754 - Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board.
 - 4. C1002 - Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases.
 - 5. E119 - Standard Test Methods for Fire Tests of Building Construction and Materials
- B. Association References:
 - 1. Gypsum Association GA 216, "Recommended Specifications for the Application and Finishing of Gypsum Board"
 - 2. Comply with "Specifications for Metal Lathing and Furring" published by the Metal Lath/Steel Framing Association.

1.03 SYSTEM DESCRIPTION

- A. Design Requirements: Fabricate and install systems as indicated but not less than that required to comply with ASTM C754 under the following conditions:
 - 1. Interior suspended ceilings and soffits: Maximum deflection of 1/360 of distance between supports.
 - 2. Exterior soffits: Withstand minimum positive and negative pressure of 20 psf with maximum deflection of 1/360 of distance between supports.
 - 3. Fire Resistance Ratings: Where fire resistance classifications are indicated, provide materials and application procedures identical to those listed by UL or tested according to ASTM E119 for type of construction shown.

1.04 SUBMITTALS

- A. Product Data: Submit product data sheets on the following materials. Data sheets shall be marked to indicate the product and sizes used.
 - 1. Metal Framing and Furring Materials

1.05 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Single Source Responsibility:
 - a. Obtain metal framing from a single manufacturer.
- B. Reference Standards:

1. Applicable requirements of ASTM C754 for installation of steel framing.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of Section 01 6000 – Product Requirements.
- B. Acceptance at Site
 1. Deliver material to site promptly without undue exposure to weather.
 2. Deliver in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade.
- C. Storage and Protection
 1. Protect materials from contamination, dampness, freezing, or overheating in accordance with manufacturer's instructions.
 2. Store above ground in dry, ventilated space.
 3. Protect materials from soiling, rusting and damage.

1.07 PROJECT CONDITIONS

- A. Project Environmental Requirements
 1. Comply with requirements of referenced standards and recommendations of material manufacturers for environmental conditions before, during, and after installation.
 2. Maintain illumination as required for proper installation of material.

1.08 WARRANTY

- A. Comply with requirements of Section 01 7800 – Closeout Submittals.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements indicated herein, provide products of one of the listed manufacturers.
- B. Suspension Systems:
 1. Armstrong World Industries, Inc: www.armstrong.com.
 2. CertainTeed Corporation: www.certainteed.com.
 3. USG: www.usg.com.
 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 CEILING AND SOFFIT SUPPORT MATERIALS

- A. Hanger Anchorage Devices: Screws, clips, bolts or other devices compatible with indicated structural anchorage for ceiling hangers and whose suitability has been proven through standard construction practices or by certified test data.
- B. Hangers
 1. Grade: Steel wire or rods, sizes to comply with requirements of ASTM C754 for ceiling or soffit area and loads to be supported.
 - a. Wire: ASTM A 641, soft, Class 1 galvanized.
 - b. Rods and flats: Mild steel components.
 2. Finish: Galvanized or painted with rust-inhibitive paint for interior Work; galvanized for exterior Work.
- C. Framing System
 1. Grade: Framing system for gypsum board panels consisting of cold-rolled steel members conforming to ASTM C635.
 2. Finish: Exposed surfaces finished in manufacturer's standard enamel paint finish.
 3. Fire Rating: Rating in accordance with U.L. assembly as indicated on the drawings.
 4. Components: Main tees, furring cross channels, furring cross tees, and cross tees.
 - a. Main Tees: Heavy Duty classification 1-1/2" high x 144" long, integral reversible splice with knurled face. (Fire rated where required).

- b. Cross Members: Members with knurled face. Cross Tees: 1-1/2" high x 48" long with 1-1/2" wide face; quick release cross tee ends for positive locking and removability without tools. (Fire rated where required).
- c. Accessory Cross Tees: Cross tees must have knurled faces and quick release cross tee ends for positive locking and removability without tools.
- 5. Accessories:
 - a. U-shaped perimeter channel molding.
 - b. Galvanized carbon steel (12 ga.) hanger wire.
- D. Hanger Wire Sound Isolators: Provide where indicated for sound-rated suspended ceilings.
- E. Miscellaneous Accessories: Provide as required for complete installations.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Install in accordance with reference standards and manufacturer's instructions.
- B. Tolerances:
 - 1. Do not exceed 1/8 inch in 8'-0" variation from plumb or level in exposed lines of surface, except at joints between gypsum board units.
 - 2. Do not exceed 1/16 inch variation between planes of abutting edges or ends.
 - 3. Shim as required to comply with specified tolerances.
- C. Install framing to comply with ASTM C754 and with ASTM C840 requirements that apply to framing installation.

3.02 EXAMINATION

- A. Site Verification of Conditions:
 - 1. Examine substrates and adjoining construction and conditions under which Work is to be installed. Do not proceed with Work until unsatisfactory conditions are corrected.

3.03 INSTALLATION

- A. Comply with provisions of Section 01 7000 – Execution and Closeout Requirements.

3.04 METAL SUPPORT INSTALLATION

- A. Ceiling Support Systems
 - 1. Secure hangers or rods to structural support by connecting directly to structure where possible; otherwise connect to inserts, clips or other anchorage devices or fasteners indicated.
 - 2. Space main runners, hangers and furring according to requirements of ASTM C754, except as otherwise indicated.
 - 3. Where spacing of structural members, or width of ducts or other equipment, prevents regular spacing of hangers, provide supplemental hangers and suspension members and reinforce nearest affected hangers to span extra distance.
 - 4. Attach directly to structural elements only, do not attach to metal deck. Loop hangers and wire-tie directly or provide anchors or inserts.

3.05 ADJUSTING

- A. Correct damage and defects which may telegraph through finished work.
- B. Leave Work smooth and uniform.

3.06 CLEANING

- A. Comply with requirements of Section 01 7000 – Execution and Closeout Requirements.
- B. At completion of each segment of installation in a room or space, promptly pick up and remove from the working area all scrap, debris, and surplus material of this Section.

END OF SECTION

SECTION 09 2236
LATH

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal lath for cement plaster.
- B. Furring for metal lath.
- C. Metal ceiling framing.

1.02 RELATED REQUIREMENTS

- A. Section 05 4000 - Cold-Formed Metal Framing: Sheathing on exterior walls.
- B. Section 07 2500 - Weather Barriers: Weather barrier under exterior plaster and stucco.
- C. Section 09 2400 - Cement Plastering.

1.03 REFERENCE STANDARDS

- A. ASTM C841 - Standard Specification for Installation of Interior Lathing and Furring; 2003 (Reapproved 2018).
- B. ASTM C847 - Standard Specification for Metal Lath; 2018.
- C. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2018.
- D. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2020.
- E. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster; 2019a.
- F. ASTM C1787 - Standard Specification for Installation of Non Metallic Plaster Bases (Lath) Used with Portland Cement Based Plaster in Vertical Wall Applications; 2014.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on furring and lathing components, structural characteristics, material limitations, and finish.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of each installation standard referenced on site throughout the duration of lathing and plastering work.
- B. Installer Qualifications: Company specializing in performing the work of this section with at least five years of documented experience.
- C. Mock-ups
 - 1. Lath and plaster an actual wall surface for each finish specified to show color, texture, and workmanship. Provide mock-ups of at least 100 sq. ft. Obtain the Architect's approval of mock-up locations.
 - 2. Simulate finished lighting conditions for the Architect's review of mock-up.
 - 3. Do not start plastering until the Architect approves mock-up. Provide additional mock-ups if necessary to obtain approval. Do not alter mock-ups until plastering is completed.
 - 4. The mock-ups may be part of the Work, and may be incorporated into the finished Work when so approved by the Architect.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Lath and Accessories:
 - 1. Cemco: www.cemcosteel.com.
 - 2. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
 - 3. Milcor Corporation: www.milcorlp.com.
 - 4. National Gypsum Company: www.national-gypsum.com.
 - 5. Niles Building Products: www.nilesbldg.com.
 - 6. United States Gypsum Company (USG): www.usg.com.

2.02 FRAMING AND LATH ASSEMBLIES

- A. Provide completed assemblies with the following characteristics:
 - 1. Maximum Deflection of Vertical Assemblies: 1:360 under lateral point load of 100 lbs.
 - 2. Maximum Deflection of Horizontal Assemblies: 1:240 deflection under dead loads and wind uplift.
- B. Fire Rated Assemblies: Provide components complying with requirements for fire rated assemblies specified in the section where the plaster finish is specified.

2.03 FRAMING MATERIALS

- A. Furring Channels: Formed steel, minimum 0.05 inch thick, 3/8 inch deep by 3/4 inch high, splicing permitted; galvanized.
- B. Main Ceiling Channels: Formed steel, asphalt coated, minimum 0.05 inch thick, 3/4 inch deep by 1-1/2 inch high, single piece, no splicing; galvanized.
- C. Hangers: Steel wire, of size and type to suit application, to support ceiling components in place to deflection limits as indicated.
- D. Ceiling Hangers: Rolled steel sections, of size and type to suit application, to rigidly support ceiling components in place to deflection limits as indicated; galvanized.
- E. Lateral Bracing: Formed steel, minimum 0.060 inch thick, size and length as required; galvanized.

2.04 LATH

- A. Diamond Mesh Metal Lath: ASTM C847, galvanized; self-furring.
 - 1. Weight: To suit application comply with deflection criteria and as specified in ASTM C841 or ASTM C1063 for framing spacing.
 - 2. Weight: 3.4 lb/sq yd.
- B. Corner Mesh: Formed sheet steel, minimum 0.018 inch thick, expanded flanges shaped to permit complete embedding in plaster, minimum 2 inch size; same finish as lath.
- C. Strip Mesh: Expanded metal lath, same weight as lath, 2 inch wide by 24 inch long; same finish as lath.
- D. Beads, Screeds, Joint Accessories, and Other Trim: Depth governed by plaster thickness, and maximum possible lengths.
 - 1. Material: Formed zinc, expanded metal flanges.
 - 2. Casing Beads with Weep Holes: Square edges.
 - 3. Corner Beads: Radiused corners.
 - 4. Base Screeds: Bevelled edges.
 - 5. Expansion Joints: Accordion profile with factory-installed protective tape, 2 inch wide flanges.
 - 6. Control Joints: Accordion profile with factory-installed protective tape, 2 inch flanges.
 - 7. Soffit Vents: Continuous one-piece Soffit Vent with reinforcing rib to key into stucco and plaster.

8. Reveal Molding: Profile and size as noted on the drawings and as required for the specific application.

2.05 ACCESSORIES

- A. Access Panels: As specified in Section 08 3100.
- B. Anchorage: Tie wire, nails, and other metal supports, of type and size to suit application; to rigidly secure materials in place, minimum G90, hot dipped galvanized.
- C. Fasteners: Self-piercing tapping screws; ASTM C1002 or ASTM C954.
- D. Tie Wire: Annealed galvanized steel.
- E. Felt Bond Breaker: Asphalt impregnated felt building paper, equivalent to two layers Grade "D" paper as required by Code.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that substrates are ready to receive work and conditions are suitable for application.
- C. Do not begin until unacceptable conditions have been corrected.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION - GENERAL

- A. Install metal lath and furring for Portland cement plaster in accordance with ASTM C1063.
- B. Install lath and furring for fire-rated assemblies in accordance with requirements of assembly as indicated.

3.03 WALL FURRING INSTALLATION

- A. Install wall furring by directly attaching to masonry and concrete walls.
- B. Install furring channels horizontally; secure with fasteners on alternate channel flanges at maximum 16 inches on center.
- C. Space furring channels maximum 16 inches on center, and not more than 4 inches away from floor and ceiling lines.

3.04 CEILING AND SOFFIT FRAMING INSTALLATION

- A. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.
- B. Install furring independent of walls, columns, and above-ceiling work.
- C. Securely anchor hangers to structural members or embed in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.
- D. Space main carrying channels at maximum 24 inch on center, and not more than 6 inches from wall surfaces. Lap splice securely.
- E. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.
- F. Install furring channels perpendicular to carrying channels at 8" on center, not more than 2 inches from perimeter walls, and rigidly secure. Lap splices securely.
- G. Reinforce openings in suspension system that interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches past each opening.
- H. Laterally brace suspension system.

3.05 CONTROL AND EXPANSION JOINT INSTALLATION

- A. Locate joints as indicated on drawings and comply with ASTM C1063.
- B. Install expansion joints where an expansion joint occurs in base exterior wall.
- C. Install prefabricated joint accessories in accordance with ASTM C1063.
- D. Construct expansion joints and control joints of back-to-back casing beads with a backer rod and sealant, set 1/4 inch apart. Lath to be cut at these joints in accordance with ASTM C1063.
- E. Install control joints at bulkheads as shown on the drawings but in no case shall they exceed 15'-0" on center, height to length ratio of 2.5, or 144 square feet max area per Code or as indicated on the drawing. Contractor shall be responsible to insure that bulkheads comply with this requirement and shall coordinate locations with the architect if not shown on the drawings.
- F. At walls, install control joints within long runs of partitions at approximately 30'-0" on center or as indicated on the drawing.

3.06 ACCESS PANELS INSTALLATION

- A. Install access panels and rigidly secure in place.
- B. Install frames plumb and level in opening. Secure rigidly in place.
- C. Position to provide convenient access to concealed work requiring access.

3.07 LATH INSTALLATION

- A. Apply lath taut, with long dimension perpendicular to supports.
- B. Lap or nest ends of metal lath in accordance with ASTM C841.
- C. Lap ends of non-metallic lath in accordance with ASTM C1787.
- D. Attach metal lath to metal supports using tie wire at maximum 6 inches on center.
- E. Attach metal lath to concrete using wire loops. Attach anchors to backup surface; space at maximum 24 inches on center. In accordance with ASTM C1063, accessories must be attached 7" o.c. max; provide zee furring over concrete and CMU unless otherwise noted.
- F. Continuously reinforce internal angles with corner mesh, except where the metal lath returns 3 inches from corner to form the angle reinforcement; fasten at perimeter edges only.
- G. Place corner bead at external wall corners; fasten at outer edges of lath only.
- H. Place perforated casing beads or weep screeds at termination of plaster areas; secure rigidly in place.
- I. Place lath vertically above each top corner and each side of door frames to 6 inches above ceiling line.
- J. Place casing beads at terminations of plaster finish. Butt and align ends. Secure rigidly in place.
- K. Place additional strip mesh diagonally at corners of lathed openings. Secure rigidly in place.
- L. Install foundation weep screeds at the bottom of exterior walls so it extends below the floor line where the wall is supported by a floor or a foundation. Through wall flashing shall be provided behind foundation weep screed.

3.08 TOLERANCES

- A. Maximum Variation from True Lines and Levels: 1/8 inch in 10 feet.
- B. Maximum Variation from True Position: 1/8 inch.

END OF SECTION

**SECTION 09 2400
CEMENT PLASTERING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cement plaster for installation over metal lath, masonry, concrete, and solid surfaces.

1.02 RELATED REQUIREMENTS

- A. Section 05 4000 - Cold-Formed Metal Framing: Structural metal framing for plaster.
- B. Section 06 1000 - Rough Carpentry: Wood stud framing for plaster.
- C. Section 09 2236.23 - Metal Lath: Metal furring and lathing for plaster.

1.03 REFERENCE STANDARDS

- A. ASTM C926 - Standard Specification for Application of Portland Cement-Based Plaster; 2018a.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittals procedures.
- B. Product Data: Provide data on plaster materials, characteristics and limitations of products specified.
- C. Samples: Submit two samples, 6 by 6 inch in size illustrating finish color and texture.
- D. Closeout Submittals:
 - 1. Submit under provisions of Section 01 7800 – Closeout Submittals.
 - 2. Submit Material Safety Data Sheets under provisions of Section 01 7800 – Closeout Submittals for the following items:
 - a. Sprayed-on or troweled-on fireproofing or decorative finish.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Minimum of twenty (20) years experience in manufacture of stucco products.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.
 - 1. Employ skilled mechanics that are experienced and knowledgeable in cement stucco application, and familiar with the requirements of the specified work.
 - 2. Successful completion of minimum of ten (10) projects of similar size and complexity to the specified project.
 - 3. Provide the proper equipment, manpower and supervision on the job site to install the system in compliance with manufacturer's published specifications and details and the project plans and specifications.
- C. Pre-installation Meetings
 - 1. Comply with provisions of Section 01 3000 – Administrative Requirements.
- D. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.06 MOCK-UP

- A. Lath and plaster an actual wall surface for each finish specified to show color, texture, and workmanship. Provide mock-ups of at least 100 sq. ft. Obtain the Architect's approval of mock-up locations.
- B. Simulate finished lighting conditions for the Architect's review of mock-up.
- C. Do not start plastering until the Architect approves mock-up. Provide additional mock-ups if necessary to obtain approval. Do not alter mock-ups until plastering is completed.

- D. Locate where directed.
- E. Accepted mock-up may remain as part of the Work.

1.07 FIELD CONDITIONS

- A. Do not apply plaster when substrate or ambient air temperature is under 50 degrees F or over 80 degrees F.
- B. Maintain minimum ambient temperature of 50 degrees F during installation of plaster and until cured.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide a warrantable assembly.
- C. Correct defective Work within a seven year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements indicated herein, provide products of one of the listed manufacturers.
 - 1. BASF Finestone: www.Finestone.BASF.com.
 - 2. Parex USA, Inc.: www.parexusa.com.
 - 3. STO Corporation: www.stocorp.com.
 - 4. TXI – Lone Star: www.txi.com.
 - 5. Substitutions: Under provisions of Section 01 6000 – Product Requirements

2.02 CEMENT PLASTER ASSEMBLIES

- A. Interior/Exterior Stucco: Cement plaster system, made of finish, brown, and scratch coat and reinforcing mesh.

2.03 PLASTER MATERIALS

- A. Premixed Scratch and Brown: Mixture of cement, aggregate, and proprietary admixtures for scratch and brown coats, installed in accordance with ASTM C926.
- B. Water: Clean, fresh, potable and free of mineral or organic matter that could adversely affect plaster.
- C. Admixture: Use stucco base manufacturer's listed admixture.
- D. Primer (required): Acrylic primer by the finish coat manufacturer.
- E. Finish Coat: Integrally colored acrylic type, color as selected.
 - 1. For finish coat: As selected from the manufacturers full range of color.
 - a. BASF Finestone Pebbletex or Aggrelastic Finishes.
 - b. Parex USA DPR or Elastic Finishes.
 - c. STO Stolit Acrylic or Aggrelastic Finishes.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- F. Bonding Agent: ASTM C 932; type recommended for bonding plaster to concrete and concrete masonry surfaces .

2.04 METAL LATH

- A. Metal Lath: Felt behind plaster and Accessories: In accordance with ASTM C1063 and as specified in Section 09 2236.23.
- B. Beads, Screeds, and Joint Accessories: In accordance with ASTM C1063 and as specified in Section 09 2236.23.

2.05 WEATHER BARRIER

- A. As specified in Section 07 2500 – Weather Barriers.

2.06 PLASTER MIXES

- A. Over Solid Bases: Three-coat application, mixed and proportioned in accordance with ASTM C926.
- B. Over Metal Lath: Three-coat application, mixed and proportioned in accordance with ASTM C926.
- C. Mix only as much plaster as can be used prior to initial set.
- D. Mix materials dry, to uniform color and consistency, before adding water.
- E. Add air entrainment admixtures to all coats to provide 5-7 percent entrainment.
- F. Protect mixtures from freezing, frost, contamination, and excessive evaporation.
- G. Do not retemper mixes after initial set has occurred.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify the suitability of existing conditions before starting work.
- B. Masonry: Verify joints are cut flush and surface is ready to receive work of this section. Verify no bituminous or water repellent coatings exist on masonry surface.
- C. Concrete: Verify surfaces are flat, honeycomb are filled flush, and surfaces are ready to receive work of this section. Verify no bituminous, water repellent, or form release agents exist on concrete surface that are detrimental to plaster bond.
- D. Metal Lath and Accessories: Verify lath is flat, secured to substrate, and joint and surface perimeter accessories are in place.
- E. Mechanical and Electrical: Verify services within walls have been tested and approved.

3.02 PREPARATION

- A. Dampen masonry surfaces to reduce excessive suction.
- B. Clean concrete surfaces of foreign matter. Clean surfaces using acid solutions, solvents, or detergents. Wash surfaces with clean water.
- C. Roughen smooth concrete surfaces and apply bonding agent in accordance with manufacturer's instructions.

3.03 PLASTERING

- A. Apply premixed plaster in accordance with manufacturer's instructions.
- B. Apply plaster in accordance with ASTM C926.
- C. Control Joint Installation:
 - 1. Joint spacing shall not be greater than 18 feet.
 - 2. No panel shall exceed 144 sq.ft. on vertical applications.
 - 3. No panel shall exceed 100 sq.ft. over curved or angular sections.
 - 4. No length-to-width ratio shall exceed 2 ½ to 1 in any given panel.
- D. Installation over cast-in-place concrete or concrete masonry units:
 - 1. Concrete and concrete masonry units require minimum 28-day cure before the installation of stucco. The requirement for a control joint every 144 sq.ft. may be waived on solid substrates without metal lath such as cast-in-place concrete and concrete masonry units provided joints in the supporting construction exist at appropriate intervals and they are reflected in the stucco. In such cases joint spacing in the stucco shall not exceed 250 sq.ft.

2. Pre-moisten concrete masonry units and absorbent concrete prior to the placement of stucco.
 3. Scratch Coat: apply the stucco with sufficient pressure to ensure intimate contact with the substrate and complete coverage to an approximate thickness of 1/4 inch. Score the stucco upon completion of each panel in preparation for a second coat. Score horizontally.
 4. Moist cure after the stucco has set by lightly fogging the surface for at least 48-hours (unless brown coat is applied as soon as the scratch coat has achieved sufficient rigidity to support the brown coat). Fog as frequently as required during the 48-hour period to prevent loss of moisture from the stucco. Avoid eroding the stucco surface with excess moisture. If relative humidity exceeds 75% the frequency of moist-curing can be diminished.
 5. Brown Coat: As soon as the first coat is firm enough to receive the second coat without damage, apply the second coat with sufficient pressure to ensure intimate contact with the first coat to an approximate thickness of 1/8 or 1/4 inch and as needed to bring the stucco to the desired thickness. Use a rod or straight edge to bring the surface to a true, even plane. Fill depressions in plane with stucco.
 6. After the stucco has lost sufficient moisture so that the surface sheen has disappeared, float the surface lightly with a darby or wood float to densify the surface and to provide a smooth, even surface. Float before the stucco becomes so rigid that it cannot be moved beneath the float.
 7. Moist cure after the stucco has set by lightly fogging the surface for at least 48-hours. Fog as frequently as required during the 48-hour period to prevent loss of moisture from the stucco. Avoid eroding the stucco surface with excess moisture. If relative humidity exceeds 75% the frequency of moist-curing can be diminished.
- E. Installation over frame construction with sheathing:
1. Scratch Coat: Apply stucco with sufficient pressure to key into and embed the metal lath. Apply sufficient material, approximately 3/8 inch, to cover the metal lath and to permit scoring the surface. Score the stucco upon completion of each panel in preparation for a second coat. Score horizontally.
 2. Brown Coat: as soon as the first coat is firm enough to receive the second coat without damage, apply the second coat with sufficient pressure to ensure intimate contact with the first coat to an approximate thickness of 1/8, 1/4 or 3/8 inch as needed to bring the stucco to a uniform thickness that matches the grounds of the accessories. Use a rod or straight edge to bring the surface to a true, even plane. Fill depressions in plane with stucco.
 3. After the stucco has become slightly firm float the surface lightly with a darby or wood float to densify the surface and to provide a smooth, even surface.
 4. Moist cure after the stucco has set by lightly fogging for at least 48 hours.
 5. Fog as frequently as required during the 48 hour period to prevent loss of moisture from the stucco. Avoid eroding the stucco surface with excess moisture. If relative humidity exceeds 75% the frequency of moist curing can be diminished.
- F. After curing, allow to dry the amount of time required by the primer/finish coat manufacturer.
- G. Finish Texture: Float to a consistent finish.
- H. Avoid excessive working of surface. Delay troweling as long as possible to avoid drawing excess fines to surface.

3.04 TOLERANCES

- A. Maximum Variation from True Flatness: 1/8 inch in 10 feet.

3.05 ADJUSTING

- A. Upon completion of the other work of this Section, inspect all cement plaster surfaces and correct conditions that do not meet specified requirements.

- B. Remove protective materials and plaster materials from adjacent surfaces, and remove stains that would adversely affect finishes.

3.06 CLEANING

- A. Comply with requirements of Section 01 7000 – Execution and Closeout Requirements.

3.07 PROTECTION

- A. Protect work so that it will be without any evidence of damage or use at time of acceptance.
- B. Provide protection of installed materials from water infiltration into or behind them.
- C. Provide protection of installed stucco from dust, dirt, precipitation, and freezing.
- D. Provide protection of installed primer and finish from dust, dirt, precipitation, freezing and continuous high humidity until fully dry.

END OF SECTION

**SECTION 09 3000
TILING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Trim and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 04 2000 - Unit Masonry.
- B. Section 05 4000 - Cold-Formed Metal Framing.
- C. Section 07 9200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
- D. Section 07 9513 - Expansion Joint Cover Assemblies: Expansion joint components.
- E. Section 09 2116 - Gypsum Board Assemblies: Tile backer board.

1.03 REFERENCE STANDARDS

- A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2017.
- B. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2016a.
- C. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, and setting details.
- D. Samples: Mount tile and apply grout on two plywood panels, minimum 12 by 12 inches in size illustrating pattern, color variations, and grout joint size variations.
- E. Grout: Submit manufacturer's full range of standard and designated color samples for each type of grout for Architect's selection.
- F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- G. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Tile: At completion of project, deliver to Owner extra stock of materials used on project as follows:
 - a. Two (2) cartons of each color of floor tile.
 - b. Two (2) cartons of each color of wall tile.
 - c. Thirty (30) lineal feet of each color and type of base.
 - 3. Store in location as directed by Owner.

4. Ensure materials are boxed and identified by manufacturer, type, and color.

1.06 QUALITY ASSURANCE

- A. Maintain one copy of and ANSI A108/A118/A136 and TCNA (HB) on site.
- B. Manufacturer Qualifications:
 1. Tile: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.
 2. Setting Materials: Minimum ten years experience in manufacturing the types of setting and grout materials specified.
 3. Membrane: Minimum five years experience in manufacturing the types of membrane materials specified.
- C. Installer Qualifications: Company specializing in performing tile installation, with minimum of five years of documented experience.

1.07 MOCK-UP

- A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.
- B. Construct tile mock-up where determined by the Architect, incorporating all components specified for the location.
 1. Minimum size of mock-up is full height of wall, 6'-0" long or as determined by the Architect to incorporate all components. More than one mock-up may be required to demonstrate all materials in the project.
 2. Mock-up shall be approved by the Architect or Architect's representative. Approved mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.09 FIELD CONDITIONS

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature of no less than 50 degrees F and no more than 100 degrees F during installation of mortar materials.

1.10 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Submit a written warranty, executed by the Contractor, Installer, and Manufacturer, agreeing to repair or replace tile that fails in materials or workmanship within the specified warranty period.
 1. Warranty Period: One (1) year after date of Substantial Completion.

PART 2 PRODUCTS

2.01 TILE

- A. Manufacturers: All products by the same manufacturer.
 1. American Olean Corporation: www.americanolean.com/#sle.
 2. Crossville Inc.: www.crossvilleinc.com.
 3. Dal-Tile Corporation: www.daltile.com/#sle.
 4. Interceramic: www.interceramicusa.com
 5. Marazzi: www.marazziusa.com
 6. USA Tile + Marble: www.usatileandmarble.net
 7. Substitutions: See Section 01 6000 - Product Requirements.
 - B. Ceramic Tile: ANSI A137.1, standard grade.
 1. Moisture Absorption: 7.0 to 20.0 percent as tested in accordance with ASTM C373.
 2. Size: As scheduled.
 3. Edges: Square.
-

4. Surface Finish: Matte glaze.
 5. Product and Color(s): See drawings for Schedule of Materials and Colors.
 6. Trim Units: Matching bead, bullnose, cove, and base shapes in sizes indicated.
- C. Porcelain Tile: ANSI A137.1, standard grade.
1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
 2. Size: As scheduled.
 3. Thickness: 3/8 inch.
 4. Edges: Square.
 5. Surface Finish: Matte glazed.
 6. Product and Color(s): See drawings for Schedule of Materials and Colors.
 7. Trim Units: Matching bullnose, double bullnose, cove base, cove, and window sill or step nosing shapes in sizes indicated.
 8. Provide Large Format Tile mortar as required according to manufacturer's recommendation.

2.02 TRIM AND ACCESSORIES

- A. Trim: Matching bullnose, cove base, and window sill or step nosing shapes in sizes coordinated with field tile.
1. Applications:
 - a. Open Edges: Bullnose.
 - b. Inside Corners: Jointed.
 - c. Floor to Wall Joints: Cove base.
 2. Manufacturers: Same as for tile.
- B. Trim: Brushed stainless steel, style and dimensions to suit application, for setting using tile mortar or adhesive.
1. Applications:
 - a. Wall corners, outside.
 - 1) Roll formed 304 (1.4301 = V2A) (EB) brushed stainless steel, perforated anchoring leg, square outer corner with 1/4" radius along the surface edge.
 - 2) Equal to Schluter - QUADDEC.
 - 3) Size: As required for tile.
 - 4) Accessories:
 - (a) Outside Corner Endcap
 - (b) Connector (stainless steel)
 - b. Wall edges, top.
 - 1) L-shaped profile with 1/8" wide top section and vertical wall section that together form the visible surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
 - 2) Material and Finish: EB - Brushed Stainless Steel Type 304 = V2A.
 - 3) Equal to Schluter - SCHIENE.
 - 4) Size: As required for tile.
 - 5) Accessories:
 - (a) Outside Corner Endcap
 - (b) Connector (stainless steel)
 - c. Floor to wall joints when coved base is not available.
 - 1) Roll formed 304 (1.4301 = V2A) (EB) brushed stainless steel profile with integrated trapezoid-perforated anchoring legs, connected at a 90 degree angle by a core-shaped section with 3/8 inch radius that forms the visible surface.
 - 2) Equal to Schluter DILEX-EHK.
 - 3) Size: As required for tile.
 - 4) Accessories:

- (a) Outside Corner (90 degrees)
 - (b) Inside Corner, 2-way (90 degrees)
 - (c) Connector
 - (d) End Cap
- d. Borders and other trim as indicated on drawings.
- 2. Manufacturers:
 - a. Schluter-Systems: www.schluter.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- C. Thresholds: Marble, solid surface or other material as indicated on the drawings; color as selected, honed finish; 2 inches wide by full width of wall or frame opening; 1/2 inch thick; beveled on long edge with radiused corners on top side; without holes, cracks, or open seams.

2.03 SETTING MATERIALS

- A. Manufacturers:
 - 1. ARDEX Engineered Cements: www.ardexamericas.com.
 - 2. Bostik Inc: www.bostik-us.com.
 - 3. Custom Building Products: www.custombuildingproducts.com.
 - 4. LATICRETE International, Inc: www.laticrete.com.
 - 5. Mapei Corporation: www.mapei.com.
 - 6. Merkrete, by Parex USA, Inc: www.merkrete.com/sle.
 - 7. TEC, an H.B. Fuller Construction Products Brand: www.tecspecialty.com/#sle.
 - 8. Substitutions: See Section 01 6000 - Product Requirements.
- B. Provide setting materials made by the same manufacturer as grout.
- C. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
 - 1. Applications: Use this type of bond coat where indicated and in thick-set applications.
- D. Epoxy Adhesive and Mortar Bond Coat: ANSI A118.3.
 - 1. Applications: Use bonding tile to steel substrates.
- E. Organic Adhesive: ANSI A136.1, thinset mastic type.
 - 1. Applications: Use for shower floors and walls.
 - 2. Use Type I in areas subject to prolonged moisture exposure.
- F. Dry-Set Portland Cement Mortar Bond Coat: ANSI A118.1.
 - 1. Applications: Use in thin-set applications.
- G. Mortar Bed Materials: Pre-packaged mix of Portland cement, sand, latex additive, and water.

2.04 GROUTS

- A. Manufacturers:
 - 1. ARDEX Engineered Cements: www.ardexamericas.com.
 - 2. Bostik Inc: www.bostik-us.com.
 - 3. Custom Building Products: www.custombuildingproducts.com.
 - 4. LATICRETE International, Inc: www.laticrete.com.
 - 5. Mapei Corporation: www.mapei.com.
 - 6. Merkrete, by Parex USA, Inc: www.merkrete.com/sle.
 - 7. TEC, an H.B. Fuller Construction Products Brand: www.tecspecialty.com/#sle.
 - 8. Substitutions: See Section 01 6000 - Product Requirements.
- B. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
 - 1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
 - 2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
 - 3. Color(s): As selected by Architect from manufacturer's full line.

- C. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
 - 1. Applications: Provide at all food preparation areas.
 - 2. Color(s): As selected by Architect from manufacturer's full line.

2.05 MAINTENANCE MATERIALS

- A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
 - 1. Applications: Between tile and plumbing fixtures.
 - 2. Color(s): As selected by Architect from manufacturer's full line.
 - 3. Products:
 - a. ARDEX Engineered Cements: www.ardexamericas.com.
 - b. Custom Building Products: www.custombuildingproducts.com.
 - c. LATICRETE International, Inc: www.laticrete.com.
 - d. Mapei Corporation: www.mapei.com
 - e. Merkrete, by Parex USA, Inc: www.merkrete.com/sle.
 - f. Substitutions: See Section 01 6000 - Product Requirements.
- B. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new portland cement grout.
 - 1. Composition: Water-based penetrating sealer.
 - 2. Products: As recommended by the grout manufacturer.

2.06 ACCESSORY MATERIALS

- A. Waterproofing Membrane: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
 - 1. Fluid or Trowel Applied Type:
 - a. Apply under all tile floors, and all floor penetrations including but not limited to floor drains and pipe penetrations as well as floor to wall intersections. Provide backer rod at floor to wall intersections and continue membrane 12" minimum up wall surface.
 - b. Thickness: 25 mils, minimum, dry film thickness.
 - c. Products:
 - 1) Basis of Design: Custom Building Products; RedGard Crack Prevention and Waterproofing Membrane: www.custombuildingproducts.com; or products of one of the following manufactures:
 - 2) ARDEX Engineered Cements: www.ardexamericas.com/#sle.
 - 3) H.B. Fuller Construction Products Inc: www.tecspecialty.com/#sle.
 - 4) LATICRETE International, Inc: www.laticrete.com/#sle.
 - 5) Mapei Corporation: www.mapei.com
 - 6) Merkrete, by Parex USA, Inc: www.merkrete.com/sle.
 - 7) Substitutions: See Section 01 6000 - Product Requirements.
- B. Reinforcing Mesh: 2 by 2 inch size weave of 16/16 wire size; welded fabric, galvanized.
- C. Deep Cleaning of Existing Tile; where noted on the drawings.
 - 1. Where tile or stone surfaces are scheduled to be "Deep Cleaned", provide a high-alkaline, two part industrial strength cleaner and degreaser for heavily soiled and neglected areas.
 - 2. Products:
 - a. Custom Building Products; Aqua Mix 1 & 2 Deep Clean: www.custombuildingproducts.com
 - b. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.
- D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within the following limits:
 - 1. Moisture Emission Rate: Not greater than 3 lb per 1000 sq ft per 24 hours, test in accordance with ASTM F1869.
 - 2. Alkalinity (pH): Verify pH range of 5 to 9, test in accordance with ASTM F710.
- E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.
- E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

- A. Install tile and grout in accordance with applicable requirements of ANSI A108.1A thru A108.13, manufacturer's instructions, and TCNA (HB) recommendations.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles square and external angles bullnosed.
- F. Install ceramic accessories rigidly in prepared openings.
- G. Install non-ceramic trim in accordance with manufacturer's instructions.
- H. Install thresholds where indicated.
- I. Sound tile after setting. Replace hollow sounding units.
- J. Keep control and expansion joints free of mortar, grout, and adhesive.
- K. Where wall or floor tile extends across EJ or CJ provide a 3/8" wide joint to align with the EJ or CJ and fill with sealant to match grout. All joints shall comply with the requirement set in the TCNA Handbook, EJ171 Movement Joint Guidelines for Ceramic, Glass and Stone.
- L. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- M. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

- N. At changes in plane, inside corners, and tile-to-tile control joints, use sanded tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
 - 1. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.
- B. Install tile-to-tile floor movement joints in accordance with TCNA (HB) Method EJ171F.

3.05 INSTALLATION - FLOORS - MORTAR BED METHODS

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F111, with cleavage membrane, unless otherwise indicated.
 - 1. Where waterproofing membrane is indicated, with standard grout or no mention of grout type, install in accordance with TCNA (HB) Method F121.
- B. Waterproofing Membrane: Install as recommended by manufacturer .
- C. Mortar Bed Thickness: 2 inch, unless otherwise indicated.

3.06 INSTALLATION - SHOWERS AND BATHTUB WALLS

- A. At tiled shower receptors install in accordance with TCNA (HB) Method B420, mortar bed floor, and W245, thin-set over coated glass mat backer board walls.
- B. Grout with latex-Portland cement grout.

3.07 INSTALLATION - WALL TILE

- A. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.
- B. Over gypsum wallboard on wood or metal studs install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.
 - 1. Where mortar bed is indicated, install in accordance with TCNA (HB) Method W222, one coat method.
 - 2. Where waterproofing membrane is indicated other than at showers and bathtub walls, install in accordance with TCNA (HB) Method W222, one coat method.
- C. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202, thin-set with dry-set or latex-Portland cement bond coat.

3.08 CLEANING

- A. Clean tile and grout surfaces.

3.09 PROTECTION

- A. Do not permit traffic over finished floor surface for 4 days after installation.

3.10 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. See Section 01 7900 - Demonstration and Training, for additional requirements.

END OF SECTION

**SECTION 09 5100
ACOUSTICAL CEILINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Decorative Grid System Trim
- C. Acoustical units.

1.02 RELATED REQUIREMENTS

- A. Section 05 3100 - Steel Decking: Placement of special anchors or inserts for suspension system.
- B. Section 07 2100 - Thermal Insulation: Acoustical insulation.
- C. Section 08 3100 - Access Doors and Panels: Access panels.

1.03 REFERENCE STANDARDS

- A. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.
- B. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2017.
- C. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.
- D. CISCA (AC) - Acoustical Ceilings: Use and Practice; 1999.
- E. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.
- C. Product Data: Provide data on suspension system components and acoustical units.
- D. Samples: Submit two samples 6 by 6 inch in size illustrating material and finish of acoustical units.
- E. Samples: Submit two samples each, 12 inches long, of suspension system main runner, cross runner, and perimeter molding.
- F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- G. Manufacturer's certificate that products meet or exceed specified requirements.
- H. Material Safety Data Sheets under provisions of Section 01 7800 - Closeout Submittals for the following items:
 - 1. All mastics, glues, and adhesives
 - 2. Acoustical ceiling tile
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.

2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.06 QUALITY ASSURANCE

- A. Fire-Resistive Assemblies: Complete assembly listed and classified by UL for the fire resistance indicated.
- B. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Installer Qualifications: An entity experienced in the installation of acoustical ceiling systems similar to requirements for this Project, and acceptable to, or licensed by, acoustical ceiling systems manufacturer.
- E. Comply with the following standards:
 - 1. CISCA (AC) "Acoustical Ceilings: Use and Practice."
 - 2. CISCA (AC) "Guidelines for Seismic Restraint Direct Hung Suspended Ceiling Assemblies."

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with pertinent provisions of Section 01 6000 – Product Requirements.
- B. Deliver acoustical ceiling system components in manufacturer's original unopened packages or containers, with labels intact.
- C. Store all components to provide suitable protection against deleterious effects from exposure to moisture, direct sunlight, or other causes.
- D. Handle all components to preclude damage. Take special precaution to prevent damage to acoustical ceiling unit edges and corners.
- E. Comply with manufacturer's Material Safety Data Sheets (MSDS) for delivery, storage, and handling of components.

1.08 FIELD CONDITIONS

- A. Maintain uniform temperature of 60 - 85 degrees F, and maximum relative humidity of 70 percent prior to, during, and after acoustical unit installation.
- B. Prior to installation, the following conditions must exist:
 - 1. All windows and exterior doors in place and roof watertight.
 - 2. Work of all wet trades completed and thoroughly dried to installation of any system components.
 - 3. Mechanical and Electrical trades shall have completed their work above ceiling line prior to acoustical ceiling systems installation. Coordinate with Mechanical and Electrical trades prior to start of installation.

1.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. The manufacturer shall provide a minimum 15-year acoustical ceiling and suspension system warranty. Warranty shall warrant against ceiling tile sagging, warping and suspension grid rusting.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acoustic Tiles/Panels:
 - 1. Armstrong World Industries, Inc: www.armstrongceilings.com.
 - 2. CertainTeed Corporation: www.certainteed.com.
 - 3. Rockfon, LLC: www.rockfon.com/#sle.

4. USG: www.usg.com.
 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Suspension Systems:
1. Same as for acoustical units.
 2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACOUSTICAL UNITS

- A. Acoustical Tile Type L1 - Standard Panel - Corridors: Painted mineral fiber, ASTM E 1264 Type III, Form 2, Sag Resistant Panels with the following characteristics:
1. Size: 24 by 24 inches.
 2. Thickness: 5/8 inches.
 3. Composition: Water felted.
 4. Light Reflectance: Not less than 85 percent, determined in accordance with ASTM E1264.
 5. NRC Range: Not less than 0.55, determined in accordance with ASTM E1264.
 6. Ceiling Attenuation Class (CAC): Not less than 33, determined in accordance with ASTM E1264.
 7. Edge: Square.
 8. Surface Color: White.
 9. Surface Pattern: CE (perforated, small holes and lightly textured)..
 10. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical tiles treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold and mildew.
 11. Products:
 - a. Basis of Design:
 - 1) Fine Fissured 1728 as manufactured by Armstrong World Industries.
 - 2) Radar 2210 as manufactured by USG.
 - b. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed in paragraph 2.01.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- B. Acoustical Tile Type L3 - Standard Panel - Classrooms, Learning Spaces, Library: Painted mineral fiber, ASTM E 1264 Type III, Form 2, Sag Resistant Panels with the following characteristics:
1. Size: 24 by 24 inches.
 2. Thickness: 3/4 inches.
 3. Composition: Water felted.
 4. Light Reflectance: Not less than 82 percent, determined in accordance with ASTM E1264.
 5. NRC Range: Not less than 0.70, determined in accordance with ASTM E1264.
 6. Ceiling Attenuation Class (CAC): Not less than 40, determined in accordance with ASTM E1264.
 7. Edge: Square.
 8. Surface Color: White or Black as schedule on the drawings.
 9. Surface Pattern: CE (perforated, small holes and lightly textured)..
 10. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical tiles treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold and mildew.
 11. Products:
 - a. Basis of Design:
 - 1) School Zone Fine Fissured 1810, as manufactured by Armstrong World Industries.
 - 2) Radar High NRC/High CAC 22421 as manufactured by USG.

- b. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed in paragraph 2.01.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- C. Acoustical Tile Type L4 - Foodservice Panel: Painted mineral fiber, ASTM E 1264 Type IX Form 2, Sag Resistant Panels with the following characteristics:
 - 1. Size: 24 by 24 inches.
 - 2. Thickness: 5/8 inches.
 - 3. Composition: Water felted.
 - 4. Light Reflectance: Not less than 80 percent, determined in accordance with ASTM E1264.
 - 5. Ceiling Attenuation Class (CAC): Not less than 40, determined in accordance with ASTM E1264.
 - 6. Edge: Square.
 - 7. Surface Color: White.
 - 8. Surface Pattern: G (smooth texture).
 - 9. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical tiles treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold and mildew.
 - 10. Products:
 - a. Basis of Design:
 - 1) Clean Room 868 as manufactured by Armstrong World Industries
 - 2) Clean Room 56099 as manufactured by USG.
 - b. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed in paragraph 2.01.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- D. Acoustical Tile Type L7 – Acoustical “Absorptive” Ceiling-General Use Panel: Painted mineral fiber, ASTM E 1264 Type IV, Form 2, Sag Resistant Panels with the following characteristics:
 - 1. Size: 24 by 24 inches.
 - 2. Thickness: 7/8 inches minimum.
 - 3. Composition: Water felted.
 - 4. Light Reflectance: Not less than 0.85 percent, determined in accordance with ASTM E1264.
 - 5. NRC Range: Not less than 0.75, determined in accordance with ASTM E1264.
 - 6. Articulation Class (AC): Not less than 170, determined in accordance with ASTM E1264.
 - 7. Ceiling Attenuation Class (CAC): Not less than 35, determined in accordance with ASTM E1264.
 - 8. Edge: Square.
 - 9. Surface Color: White.
 - 10. Surface Pattern: E (lightly textured).
 - 11. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical tiles treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold and mildew.
 - 12. Products:
 - a. Basis of Design:
 - 1) Fine Fissured High NRC 1754 as manufactured by Armstrong World Industries
 - 2) Mars High NRC/High CAC as manufactured by USG.
 - b. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed in paragraph 2.01.
 - c. Substitutions: See Section 01 6000 - Product Requirements.

2.03 SUSPENSION SYSTEM(S)

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.
- B. Exposed Steel Suspension System: Formed steel, commercial quality cold rolled; heavy-duty.
 - 1. Profile: Tee; 15/16 inch wide face, main tee 1-1/2 inch, cross tee 1-1/2 inch.
 - 2. Construction: Double web.
 - 3. Finish: White painted.
 - 4. Products:
 - a. Basis of Design for Non-Fire Rated Assemblies – Ceiling Types I, II, V, VI, VII and IX: "Prelude XL Galvanized Capped" as manufactured by Armstrong World Industries
 - b. Basis of Design for Non-Fire Rated Assemblies – Ceiling Types III, IV: "Prelude XL Aluminum Capped" as manufactured by Armstrong World Industries
 - c. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed in paragraph 2.01. Ceiling Tile and Grid shall be as approved by the manufacturer.
 - d. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.
 - 1. Angle Hangers: ASTM A 446 steel with G90 coating.
 - 2. Flat Hangers: Zinc-coated steel.
 - 3. Hanger Rods: Zinc-coated steel.
- B. Perimeter Moldings: Same material and finish as grid.
 - 1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.
- C. Decorative Grid System Trim
 - 1. Physical properties.
 - a. Extruded aluminum alloy 6063 trim channel, 10' straight or curved profiles.
 - b. Concealed connections to grid with T-bar connection clip, including all necessary trim for corners inside and outside and all accessories.
 - c. Size: 6 inch" wide face with 3/4" horizontal legs, straight or curved sections with special bosses formed for attachment to Axiom T-bar connection clip or hanging clip.
 - d. Color: Match color of grid.
 - e. Finish: Factory-applied baked polyester paint.
 - 2. Products:
 - a. Basis of Design: Axiom, Classic Trim as manufactured by Armstrong World Industries.
 - b. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed in paragraph 2.01.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- D. Acoustical Sealant For Perimeter Moldings: Non-hardening, non-skinning, for use in conjunction with suspended ceiling system.
- E. Touch-up Paint: Type and color to match acoustical and grid units.
- F. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with UL design requirements ASTM C 636/C 636M, ASTM E 580/E 580M, and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.
- D. Main runners directly suspended by minimum 12 gage galvanized steel wire; hanger wire wrapped tightly a minimum three full turns.
 - 1. Runner Spacing: 4'-0".
 - 2. Hanger Spacing: 4'-0".
- E. Main runners interconnected by cross-tees to form modules as shown on reflected ceiling plans. Suitable cross-tee lengths adjacent to recessed light fixtures on each side not supported by a main runner.
 - 1. Cross-Tee Spacing: 4'-0".
- F. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
- G. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.
- H. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- I. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- J. Do not eccentrically load system or induce rotation of runners.
- K. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Use longest practical lengths.
 - 2. Overlap and rivet corners.
- L. Add extra ceiling wire at each corner of light fixtures and grilles.
- M. Fire rated main runner/cross runner fire expansion relief cutout shall be evaluated for load performance where field application requires the expansion relief to be designed more than 3" from the closest support point.
- N. Form expansion joints as detailed. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.

3.03 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Install acoustical ceiling units from a three-carton mix to obtain uniform distribution of surface variations.
- D. Fit border trim neatly against abutting surfaces.

- E. Install units after above-ceiling work is complete.
- F. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- G. Cutting Acoustical Units:
 - 1. Cut to fit irregular grid and perimeter edge trim.
 - 2. Make field cut edges of same profile as factory edges.
- H. Sound walls: Set acoustical ceiling boards in four continuous beads of 1/4" diameter sealant, one at top of each edge of the gypsum drywall and two on top of the top metal runner track.
- I. Install hold-down clips on each panel to retain panels tight to grid system at rated assemblies; comply with fire rating requirements.

3.04 ADJUSTMENTS

- A. Make adjustments in ceiling system as necessary to ensure compliance with this specification.
- B. Remove and replace damaged or soiled acoustical ceiling units.

3.05 CLEANING

- A. Remove debris which may have been caused during installation of this work.
- B. In addition to other stipulated requirements for cleaning, completely remove fingerprints and traces of soil from the surfaces of grid and acoustical materials, using only those cleaning materials recommended for the purpose by the manufacturer of the material being cleaned.

END OF SECTION

SECTION 09 6429
WOOD STRIP AND PLANK FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wood strip flooring, nailed.
- B. Hardboard stage flooring
- C. Secondary subflooring.
- D. Sleepers.
- E. Sheet vapor retarder.
- F. Surface finishing.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete subfloor surface.
- B. Section 06 1000 - Rough Carpentry: Wood subfloor surface.
- C. Section 09 9000 - Painting and Coating: Surface finish to flooring.

1.03 REFERENCE STANDARDS

- A. NWFA (IG) - Installation Guidelines; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for flooring.
- C. Shop Drawings: Indicate floor joint pattern and termination details.
- D. Samples: Submit two samples 12 by 12 inch in size illustrating floor finish, color, and sheen.
- E. Installation Instructions: Indicate standard and special installation procedures.
- F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, a suggested schedule for cleaning, stripping and re-finishing recommendations, stain removal methods, and polishes and waxes.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Deliver extra material to Owner. Before installation begins, furnish not less than 1.0 percent of the quantity of each type wood flooring installed on the Project, packaged with protective covering for storage and identified with labels clearly describing contents.

1.05 QUALITY ASSURANCE

- A. Perform work of this section in accordance with NWFA (IG).
 - 1. Maintain one copy of each document on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.
- D. The flooring contractor shall be an MFMA Mill Accredited Installation Company and also a accredited installer of Robbins, Connor, or Aacer Flooring with MFMA accredited installer(s) on-site for the duration of the wood floor installation.

1.06 FIELD CONDITIONS

- A. Do not install wood flooring until wet construction work is complete and ambient air at installation space has moisture content stabilized at maximum moisture content of 40 percent.

- B. Provide heat, light, and ventilation prior to installation.
- C. Store materials in area of installation for minimum period of 24 hours prior to installation.
- D. Maintain minimum room temperature of 65 degrees F for a period of two days prior to delivery of materials to installation space, during installation, and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hardwood Strip and Plank Flooring:
 - 1. Connor Sports Flooring: www.connorfloor.com.
 - 2. Robbins Sports Surfaces: www.robbsfloor.com.
 - 3. Substitutions: Section 01 6000 - Product Requirements.

2.02 MATERIALS

- A. Wood Strip Flooring:
 - 1. Species: Pine or Fir.
 - 2. Grade: AWI Premium Grade/Select, #1.
 - 3. Cut: Flat grain.
 - 4. Moisture Content: 7 to 9 percent.
 - 5. Actual Thickness: 25/32 inch.
 - 6. Actual Width: 2-1/4 inches.
 - 7. Edge: Tongue and Groove.
 - 8. End: End matched.
 - 9. Length: Random, minimum of 9 inches.
- B. Hardboard Stage Floor. Tempered hardboard, 1/4 inch thick.
 - 1. Georgia-Pacific Wood Products LLC: www.buildgp.com.
 - 2. Masonite International Corp.: www.masonite.com.
 - 3. Substitutions: Section 01 6000 - Product Requirements.
- C. Flooring Nails: Type recommended by flooring manufacturer.
- D. Sleepers and Shims: Softwood lumber, pressure treated for moisture protection, 2 by 3 inch size.
- E. Secondary Subflooring: 1 layer 3/4 inch thick plywood, with square edges; Exposure 1, unsanded.
 - 1. Provide 1 layer 3/4 inch and 1 layer 1/2 inch at hardboard floor.

2.03 ACCESSORIES

- A. Ventilating Base: Molded rubber, 4 inch high with a 3 inch toe, ventilating type, with adhesives and accessories; color as selected.
- B. Wood Plugs: Round shape, 3/4 inch diameter by 1/8 inch thick, of same species as flooring.
- C. Floor Finish
 - 1. Lightly sand floor finish and sweep clean.
 - 2. 1st Coat: SW Enamel Undercoater
 - 3. 2nd/3rd Coat: SW Pro-Mar 200 Latex Paint, Flat Black.

2.04 SOURCE QUALITY CONTROL

- A. Inspect and stamp species and grade on underside of each piece of wood flooring at factory.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting this work.
 - B. Verify that concrete subfloor surface is smooth and flat to plus or minus 1/4 inch in 10 feet.
-

- C. Verify wood subfloor is properly secured, smooth and flat to plus or minus 1/4 inch in 10 feet.
- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Sleepers and Shims:
 - 1. Place vapor retarder over subfloor surface, lapping edges and ends minimum 6 inches and tape seal; spot glue in place.
 - 2. Place sleepers over vapor retarder; space sleepers at 8 inches on center.
 - 3. Shim underside of sleepers to achieve level line of plus or minus 1/4 inch in 10 feet.
 - 4. Anchor sleepers to concrete substrate with explosive driven concrete nails; place nails at 16 inches on center.
 - 5. Anchor sleepers to wood substrate with cement-coated nails; place nails at 16 inches on center.
- B. Secondary Subflooring: Place plywood subflooring over sleepers.
 - 1. Lay perpendicular to the sleepers, with end joints over sleepers, and nail at 12 inches on center.
- C. Prepare substrate to receive wood flooring in accordance with manufacturer's and NWFA instructions.
- D. Broom clean substrate.

3.03 INSTALLATION

- A. Sheathing Paper: Place over wood subfloor; lap edges and ends 2 inches, staple in place.
- B. Wood Flooring:
 - 1. Install in accordance with manufacturer's and NWFA instructions; predrill and blind nail to subfloor.
 - 2. Lay flooring parallel to length of room areas. Verify alignment as work progresses.
 - 3. Arrange flooring with end matched grain set flush and tight.
 - 4. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar; provide divider strips and transition strips in accordance with flooring manufacturer's recommendations and as indicated.
 - 5. Install edge strips at unprotected or exposed edges, and where flooring terminates.
 - 6. Secure edge strips before installation of flooring with stainless steel screws.
 - 7. Install flooring tight to floor access covers.
 - 8. Provide 1-1/2 inch expansion space at fixed walls and other interruptions.
- C. Install base at floor perimeter to cover expansion space in accordance with manufacturer's instructions. Miter inside and outside corners.
- D. Finishing:
 - 1. Mask off adjacent surfaces before beginning sanding.
 - 2. Sand flooring to smooth even finish with no evidence of sander marks. Take precautions to contain dust. Remove dust by vacuum.
 - 3. Apply first coat, allow to dry, then buff lightly with steel wool to remove irregularities. Vacuum clean and wipe with damp cloth before applying succeeding coat.
 - 4. Lightly buff between coats with steel wool and vacuum clean before applying succeeding coat.
 - 5. Apply last coat of finish.

3.04 CLEANING

- A. Clean and polish floor surfaces in accordance with floor finish manufacturer's instructions.

3.05 PROTECTION

- A. Prohibit traffic on floor finish for 48 hours after installation.
-

- B. Place protective coverings over finished floors; do not remove coverings until Date of Substantial Completion.

END OF SECTION

**SECTION 09 6500
RESILIENT FLOORING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient tile flooring including layered vinyl tile.
- B. Resilient base.
- C. Installation accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors.

1.03 REFERENCE STANDARDS

- A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2017.
- B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2017.
- C. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile; 2013a.
- D. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2015.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Verification Samples: Submit two samples, 12 by 12 inch in size illustrating color and pattern for each resilient flooring product specified.
- D. Concrete Testing Standard: Submit a copy of ASTM F710.
- E. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of sub-floor is acceptable.
- F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Flooring Material: 2% of each type and color.
 - 3. Extra Wall Base: Two (2) boxes of of the same color and size of rubber base as used in the project. Extra material to be provided in boxes of 4' lengths only, no coiled base.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years experience.
- B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.

- C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- D. Do not double stack pallets.

1.07 FIELD CONDITIONS

- A. Maintain temperature in storage area between 65 degrees F and 85 degrees F.
- B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 65 degrees F.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Submit a written warranty, executed by the Contractor, Installer, and Manufacturer, agreeing to repair or replace flooring that fails in materials or workmanship within the specified warranty period.
 - 1. Workmanship Warranty Period: One (1) year after date of Substantial Completion.
 - 2. Material Warranty shall be twenty (20) years after date of Substantial Completion.

PART 2 PRODUCTS

2.01 TILE FLOORING

- A. Vinyl Tile (LVT): Printed film type, with transparent or translucent wear layer.
 - 1. Manufacturers:
 - a. Mohawk Group: www.mohawkgroup.com/#sle.
 - b. Tarkett: www.tarkett.com.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
 - 2. Minimum Requirements: Comply with ASTM F1700, of Class corresponding to type specified.
 - 3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or ASTM E 648.
 - 4. Tile Size: As scheduled.
 - 5. Wear Layer Thickness: 0.020 inch.
 - 6. Total Thickness: 0.125 inch.
 - 7. Product/Color/Pattern: Refer to Section 01 6210 Schedule of Materials and Colors.

2.02 RESILIENT BASE

- A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
 - 1. Manufacturers:
 - a. Burke Flooring: www.burkeflooring.com.
 - b. Flexco, Inc: www.flexcofloors.com.
 - c. Johnsonite, a Tarkett Company: www.johnsonite.com.
 - d. Roppe Corp: www.roppe.com.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
 - 2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or ASTM E 648.
 - 3. Height: 4 inch.
 - 4. Thickness: 0.125 inch.
 - 5. Length: Roll.
 - 6. Basis of Design and Color: Refer to drawings and Schedule of Materials and Colors.
 - 7. Accessories: Premolded external corners where return is 3" or less.

2.03 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Adhesives

1. Provide only high moisture and alkali tolerant type adhesive as recommended by the manufacturer of the material being installed. Adhesive shall have RH of 99 or higher.
 2. Asphalt emulsions and other non-waterproof adhesives will not be acceptable.
 3. Contact manufacturer for recommended adhesive if pH levels exceed 9 or MVER exceeds 5 pounds.
- C. Where the moisture-vapor-emission rate exceeds the manufacturers allowable rate provide and install a moisture mitigating primer as recommended by the manufacturer.
- D. Moldings, Transition and Edge Strips: Metal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and pH.
1. Test in accordance with ASTM F710.
- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Clean substrate.
- C. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION - GENERAL

- A. Install in accordance with manufacturer's written instructions.

3.04 INSTALLATION - TILE FLOORING

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
- B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.
- C. Install tile to pattern as indicated. Allow minimum 1/2 full size tile width at room or area perimeter.

3.05 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
- B. Miter internal corners. At external corners, use premolded units. At returns of 3" or less, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.
- E. Provide continuous sealant at top of base in all Foodservice areas including kitchens, food storage, serving lines, etc. Color as selected by Architect.

3.06 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.
1. LVT: Initial Maintenance and Preparation for Commercial Traffic

- a. Sweep, dust mop or vacuum the floor thoroughly to remove all loose dust, dirt, grit and debris.
- b. Remove any dried adhesive residue with a clean, white cloth dampened with mineral spirits, carefully following warnings on the container.
- c. Damp mop the floor with a properly diluted neutral (pH 6 to 8) detergent solution such as Armstrong S-485 Commercial Floor Cleaner.
- d. If necessary, scrub the floor using a rotary machine or auto scrubber with a properly diluted neutral detergent solution such as Armstrong S-485 Commercial Floor Cleaner and the appropriate scrubbing brush (aggressiveness equivalent to 3M red pad for light scrub, 3M blue pad or equal for a deep scrub).
- e. Thoroughly rinse the entire floor with fresh, clean water. Remove rinse water and allow the floor to dry completely.

3.07 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.
- B. Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings.
- C. If it becomes necessary to move any heavy fixtures or appliances over the flooring on casters or dollies, the flooring should be protected with 1/4" or thicker plywood, hardboard or other underlayment panels. If other on-site work is continuing, use a protective covering such as plain, undyed kraft paper to guard against damage to the new floor.

END OF SECTION

**SECTION 09 6816
SHEET CARPETING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Carpet, direct-glued.
- B. Walk-Off Tile Carpeting.
- C. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied carpet.

1.03 REFERENCE STANDARDS

- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016.
- B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2017.
- C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2017.
- D. CRI 104 - Standard for Installation of Commercial Carpet; 2015.
- E. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2015.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate seaming plan, method of joining seams, direction of carpet pile and pattern, location of edge moldings and edge bindings.
- C. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- D. Samples: Submit three samples 12 by 12 inch in size illustrating color and pattern for each carpet material specified.
- E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
 - 1. Instruct the owner's personnel in the care and maintenance of the flooring. Instruction and maintenance shall be performed by the flooring subcontractor and a representative of the flooring manufacturer. Refer to Section 01 7800 - Closeout Documents for additional requirements and information.
 - 2. The demonstration shall include written guidelines for the proper equipment, operation, materials and manufacturers recommended schedule of maintenance. See Section 01 7900 - Demonstration and Training for additional information.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional requirements.
 - 2. Extra Carpet: Quantity equal to 3 percent of total installed of each color and pattern installed.
 - 3. The extra stock is to be unused rolls, tiles and mats of the same run as installed and does not include scraps.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet with minimum five years documented experience.
- B. Installer Qualifications: Company specializing in installing carpet with minimum five years documented experience.

1.06 MOCK-UP

- A. Provide a 12' x 12' mock-up, illustrating all colors and patterns that will be installed for approval by the Architect and Owner before installation of the remainder of the project.
- B. See Section 01 4000 - Quality Requirements for additional requirements.
- C. Locate where directed.
- D. Accepted mock-up may remain as part of the Work.

1.07 FIELD CONDITIONS

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.
- B. Maintain minimum 70 degrees F ambient temperature 24 hours prior to, during and 24 hours after installation.
- C. Ventilate installation area during installation and for 72 hours after installation.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Submit a written warranty, executed by the Contractor, Installer, and Manufacturer, agreeing to repair or replace tile that fails in materials or workmanship within the specified warranty period.
 - 1. Warranty Period: Tarkett Lifetime Warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Carpet, (Rolled and Walk-off):
 - 1. Tarkett: www.tarkett.com.
 - 2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 CARPET

- A. Carpet, Rolled: Tufted, nylon.
 - 1. Product/Color/Pattern: See Section 01 6210 - Schedule of Materials and Colors.
 - a. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
 - b. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
 - c. Primary Backing: Non-woven synthetic fiber
 - d. Secondary Backing: Powerbond Closed Cell Cushion
- B. Carpet, Type WC: Walk-Off Carpet
 - 1. Product Line / Color: See Section 01 6210 - Schedule of Materials and Colors.
 - a. Backing: Powerbond Closed Cell Cushion
 - b. Construction: Accuweave® Patterned Loop
 - c. Fiber System: Nylon with Static Control & Ensure
 - d. Dye Method: 100% Solution Dyed

2.03 ACCESSORIES

- A. Sub-Floor Filler: Type recommended by carpet manufacturer.
- B. Edge Strips: Vinyl, color as selected.
 - 1. Product: Burke Flooring; Tile and Carpet Joiner No. 150: www.burkemercer.com.

- C. Adhesives:
 - 1. Provide only high moisture and alkali tolerant type adhesive as recommended by the manufacturer of the material being installed.
 - 2. Contact manufacturer for recommended adhesive if pH levels exceed 9 or MVER exceeds 5 pounds.
 - 3. Asphalt emulsions and other non-waterproof adhesives will not be acceptable.
- D. Where the moisture-vapor-emission rate exceeds the manufacturers allowable rate provide and install a moisture mitigating primer as recommended by the manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive carpet.
- B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesives to sub floor surfaces.
- C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and alkalinity (pH).
 - 1. Test in accordance with ASTM F710.
 - 2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.
- C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- D. Clean substrate.

3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of sub-floor conditions.
- B. Install carpet and cushion in accordance with manufacturer's instructions and CRI 104 (Commercial).
- C. Verify carpet match before cutting to ensure minimal variation between dye lots.
- D. Lay out carpet and locate seams in accordance with shop drawings.
 - 1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
 - 2. Do not locate seams perpendicular through door openings.
 - 3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
 - 4. Locate change of color or pattern between rooms under door centerline.
 - 5. Provide monolithic color, pattern, and texture match within any one area.
- E. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.
- F. Install carpet tile in accordance with manufacturer's instructions and CRI 104 (Commercial).
- G. Blend carpet from different cartons to ensure minimal variation in color match.
- H. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

- I. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.
- J. Locate change of color or pattern between rooms under door centerline.
- K. Fully adhere carpet tile to substrate.
- L. Trim carpet tile neatly at walls and around interruptions.
- M. Complete installation of edge strips, concealing exposed edges.

3.04 DIRECT-GLUED CARPET

- A. Double cut carpet seams, with accurate pattern match. Make cuts straight, true, and unfrayed. Apply seam adhesive to cut edges of woven carpet immediately.
- B. Apply contact adhesive to floor uniformly at rate recommended by manufacturer. After sufficient open time, press carpet into adhesive.
- C. Apply seam adhesive to the base of the edge glued down. Lay adjoining piece with seam straight, not overlapped or peaked, and free of gaps.
- D. Roll with appropriate roller for complete contact of adhesive to carpet backing.
- E. Trim carpet neatly at walls and around interruptions.

3.05 CLEANING

- A. Remove excess adhesive from floor and wall surfaces without damage.
- B. Clean and vacuum carpet surfaces.
- C. Provide a heavy non-staining paper or plastic walkway as required over carpeting in direction of traffic, maintaining intact until carpeted space is accepted by the Owner.

3.06 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

END OF SECTION

**SECTION 09 8400
ACOUSTICAL PANELS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fabric-covered fiberglass core panels and mounting accessories.
- B. Formed fire resistant plastic panels
- C. Cementitious wood fiber acoustical panels

1.02 RELATED REQUIREMENTS

- A. Section 09 5100 - Acoustical Ceilings

1.03 REFERENCE STANDARDS

- A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2017.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- C. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests; 2016.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed data sheets for products specified.
- C. Shop Drawings: Fabrication and installation details, panel layout, and fabric orientation.
- D. Selection Samples: Manufacturer's color charts for fabric covering, indicating full range of fabrics, colors, and patterns available .
- E. Verification Samples: Fabricated samples of each type of panel specified; 12 by 12 inch, showing construction, edge details, and fabric covering.
- F. Test Reports: Certified test data from an independent test agency verifying that panels meet specified requirements for acoustical and fire performance.
- G. Closeout Submittals
 - 1. Submit under provisions of Section 01 7800 - Closeout Submittals.
 - 2. Submit Material Safety Data Sheets under provisions of Section 01 7800 - Closeout Submittals for the following items:
 - a. All mastics, glues, and adhesives
 - b. Thermal insulation (excluding fiberglass, foam, rubber)

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company with not less than five years of experience in manufacturing acoustical products similar to those specified.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect acoustical panels from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until panels are needed for installation.
- B. Store panels flat, in dry, well-ventilated space; do not stand panels on end.
- C. Protect panel edges from damage.

1.07 WARRANTY

- A. Comply with requirements of Section 01 7800 - Closeout Submittals.

- B. Submit a written warranty, executed by the Contractor, agreeing to repair or replace panels that fail in materials or workmanship within the specified warranty period.
 - 1. Warranty Period: Two (2) years after date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fabric-Covered Acoustical Panels:
 - 1. Acoustical Products and Systems: www.acousticalproducts.com.
 - 2. Armstrong World Industries, Inc: www.armstrong.com.
 - 3. AVL Systems, Inc.: www.AVLOnline.com
 - 4. CertainTeed Corporation: www.certainteed.com.
 - 5. Conwed Designscape | Wall Technology: www.conweddesignscape.com.
 - 6. Essi Acoustical Products Company: www.essiacoustical.com.
 - 7. Quiet Technology Systems: www.qtechsys.com
 - 8. USG: www.usg.com.
 - 9. Wenger Corporation: www.wengercorp.com.
 - 10. Substitutions: See Section 01 6000 - Product Requirements.
- B. Cementitious Wood Fiber Acoustical Panels
 - 1. Cardinal Acoustics: www.cardinalacoustics.com
 - 2. Tectum, Inc.: www.tectum.com
 - 3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FABRIC-COVERED ACOUSTICAL PANELS

- A. Panels: Prefinished, factory assembled fabric-covered panels.
 - 1. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
- B. Fiberglass Core Panels: Typical, Unless Noted Otherwise
 - 1. Density: 6 to 7 lb/cu ft.
 - 2. Noise Reduction Coefficient (NRC): 0.80 to 0.90 when tested in accordance with ASTM C423 for Type A mounting, per ASTM E795.
 - 3. Panel Width: As detailed.
 - 4. Panel Height: As detailed.
 - 5. Panel Thickness: 2 inch.
 - 6. Edges: Perimeter edges reinforced by a formulated resin hardener.
 - 7. Edge Profile: Beveled
 - 8. Corners: Square.
 - 9. Mounting: Mounting shall be continuous Z-bars per architectural drawings. All mountings are supplied by the manufacturer unless noted otherwise.
- C. Fiberglass Core and Formed Fire Resistant Plastic Panels: Band and Choir Rooms
 - 1. Absorber Panels:
 - a. Fiberglass Core Density: 6 to 7 lb/cu ft.
 - b. Edges: Perimeter edges reinforced by a formulated resin hardener.
 - c. Panel Thickness: 2 inch at Music, Choir and 4 inch at Band Halls.
 - d. Edge Profile: Square
 - e. Corners: Square.
 - 2. Diffuser Panels:
 - a. Diffuser Construction: 0.125 inch Thermo-formed fire resistant plastic molded to a one-piece Barrel or a special offset Pyramidal shape.
 - b. All diffuser panels constructed of Class A materials (NFPA 101 Life Safety Code Requirements for Class A Interior Finishes are: Flame Spread 0-25, Smoke Developed 0-450).

- c. Edge Profile: No flange for walls and hardware ceiling mount.
- d. Corners: Radiused.
- 3. Acoustical Performance Requirements
 - a. Sound absorption coefficients, measured with a Type A and Type E-400 mounting, according to ASTM E795 (if applicable) or according to application mounting method, determined by ASTM C423.
 - b. Sound Transmission Class (STC), determined according to ASTM E90 and ASTM E413: Type I convex ceiling diffuser panel, 4' x 4'; STC 23; Type I pyramidal ceiling diffuser panel, 4' x 4'; STC 22.
- 4. Finishes
 - a. Ceiling/Wall-mounted absorber panels: Fabric wrap entire core and glued to back of panel.
 - b. Ceiling/Wall-mounted diffuser panels: Manufacturer's standard white, "orange peel" texture.
- 5. Mounting Hardware
 - a. Wall mounting (absorbers and diffusers): Continuous wall and panel Z-bars per architectural drawings. Provide 2" minimum clearance above top of panel for placement and removal of panel.
 - b. Ceiling mounting (absorbers and diffusers): Four corner hook suspended by wire to ceiling; lay-in hardware for ceiling grid; (minimum frame width 15/16"); direct ceiling mounting hardware.
- 6. Panel Width: As detailed.
- 7. Panel Height: As detailed.
- D. Fabric Covering: Seamless fabric facing material, for bonded covering of core material.
 - 1. Fabric shall be applied directly to the face and edges of the panel and return to the back of the panel to provide a full finished edge. All corners are fully tailored.
 - 2. Fabric: See Section 01 6210 - Schedule of Materials and Colors for fabric selection.
 - 3. Patterns: Where fabric with directional or repeating patterns or fabric with directional weave is used, mark for installation in same direction.

2.03 CEMENTITIOUS WOOD FIBER ACOUSTICAL PANELS

- A. Standard Interior Wall Panels:
 - 1. Material: Aspen wood fibers bonded with inorganic hydraulic cement.
 - 2. Thickness: 1 inch.
 - 3. Panel Dimensions: Reference drawings
 - 4. Color: Painted, See Section 01 6210 - Schedule of Materials and Colors
 - 5. Mounting: Mounting shall be continuous Z-bars on 1X furring strips per architectural drawings. All mountings are supplied by the manufacturer unless noted otherwise. Attach to wall on 1X furring strips.
 - 6. Performance Requirements:
 - a. Provide acoustical wall panel assembly designed and tested to provide surface burning characteristics (ASTM E84) as follows:
 - 1) Flamespread: 0.
 - 2) Smoke Developed: 0.
 - b. Provide acoustical wall panel system which has been manufactured, fabricated and installed to provide Noise Reduction Coefficient (NRC) rating as follows:
 - 1) Panel thickness of 1 inch: 0.60 minimum.

2.04 FABRICATION

- A. Fabric Wrapped, General: Fabricate panels to sizes and configurations indicated, with fabric facing installed without sagging, wrinkles, blisters, or visible seams.

1. Where radiused or mitered corners are indicated, install fabric to avoid seams or gathering of material.
- B. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch for thickness, overall length and width, and squareness from corner to corner.

2.05 ACCESSORIES

- A. Back-Mounting Accessories: Manufacturer's standard accessories for concealed support, designed to allow panel removal, and as follows:
 1. Mounting shall be continuous Z-bars on 1X furring strips per architectural drawings. All mountings are supplied by the manufacturer unless noted otherwise
- B. Ceiling-Suspended Accessories: Manufacturer's standard through-threaded eyelets bolted through concealed perimeter frame at 1/4 points on each panel, sized appropriately for weight of panels.
 1. Provide galvanized wire for suspension from ceiling at heights indicated.
- C. Trim Moldings: Manufacturer's standard wood or vinyl trim moldings for concealing panel joints; color as selected from manufacturer's standards.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates for conditions detrimental to installation of acoustical panels. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install acoustical panels in locations indicated, following installation recommendations of panel manufacturer. Align panels accurately, with edges plumb and top edges level. Scribe to fit accurately at adjoining work and penetrations.
- B. Install panels to construction tolerances of plus or minus 1/16 inch for the following:
 1. Plumb and level.
 2. Flatness.
 3. Width of joints.

3.03 CLEANING

- A. Clean fabric facing upon completion of installation from dust and other foreign materials, following manufacturer's instructions.
- B. Remove surplus materials, trimmed portions of panels, and debris resulting from installation.

3.04 PROTECTION

- A. Provide protection of installed acoustical panels until completion of the work.
- B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

END OF SECTION

**SECTION 09 9000
PAINTING AND COATING**

PART 1 - GENERAL

1.01 SUMMARY

- A. Related Documents: General and Supplementary Conditions of the Contract, Division 01 General Requirements, and Drawings are applicable to this Section.
- B. Section Includes, but is not limited to:
 - 1. Exterior paints and coatings systems including; paints, stains, transparent coatings, and opaque finishes.
 - 2. Interior paint and coatings systems including; paint, stains, transparent coatings, and opaque finishes.
 - 3. Specific products and painting scheduled in this Section are based, in general, on products of Sherwin-Williams Company (noted SW). Products of other manufacturers listed in paragraph 2.01 may be substituted with approved color matches.
- C. Related Sections
 - 1. Section 05 2100 - Steel Joist Framing: Shop priming
 - 2. Section 05 5000 - Metal Fabrications: Shop priming
 - 3. Section 06 2000 - Finish Carpentry: Back priming of trim and paneling
 - 4. Division 23 - Mechanical Identification: Markers and color-coding
 - 5. Division 26 - Electrical Identification: Markers and color-coding

1.02 REFERENCES

- A. Industry Association Standards
 - 1. SSPC-SP 1 - Solvent Cleaning.
 - 2. SSPC-SP 2 - Hand Tool Cleaning.
 - 3. SSPC-SP 3 - Power Tool Cleaning.
 - 4. SSPC-SP 13 / NACE No. 6 Surface Preparation for Concrete.

1.03 DEFINITIONS

- A. Paint
 - 1. Means coating systems materials including primers, emulsions, epoxy, enamels, sealers, fillers, and other applied materials whether used as prime, intermediate, or finish coats.

1.04 SUBMITTALS

- A. Shop drawings, product data, and samples under provisions of Section 01 3000 - Administrative Requirements.
- B. Product Data: Manufacturer's data sheets on each paint and coating product should include:
 - 1. Product characteristics
 - 2. Surface preparation instructions and recommendations
 - 3. Primer requirements and finish specification
 - 4. Storage and handling requirements and recommendations
 - 5. Application methods
 - 6. Cautions
- C. Selection Samples: Submit a complete set of color chips that represent the full range of manufacturer's color samples available.
- D. Verification Samples: For each finish product specified, submit 8"x10" samples that represent actual product, color, and sheen.
- E. Closeout Submittals
 - 1. Submit under provisions of Section 01 7800 - Closeout Submittals.

2. Upon conclusion of the project, the Contractor or paint manufacture/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams "Custodian Project Color and Product Information" report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touchup procedures, and color samples of each color and finish used.

1.05 QUALITY ASSURANCE

- A. Qualifications
 1. Single Source Responsibility:
 - a. Obtain each type of material required from single source.
- B. Pre-installation Meetings
 1. Comply with provisions of Section 01 3000 - Administrative Requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of Section 01 6000 - Product Requirements.
- B. Delivery: Deliver manufacturer's unopened containers to the work site. Packaging shall bear the manufacturer's name, label, and the following list of information:
 1. Product name, type (description)
 2. Application and use instructions
 3. Surface preparation
 4. VOC content
 5. Environmental issues
 6. Batch date
 7. Color number
- C. Storage: Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.
- D. Store materials in an area that is within the acceptable temperature range, per manufacturers instructions. Protect from freezing.
- E. Handling: Maintain a clean, dry storage area, to prevent contamination or damage to the coatings.

1.07 PROJECT CONDITIONS

- A. Project Environmental Requirements
 1. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not apply coatings under environmental conditions outside manufacturer's absolute limits.

1.08 MAINTENANCE

- A. Extra Materials
 1. At completion of project, deliver to Owner extra stock of materials used on project as follows:
 - a. Additions and Renovations - Ten (10) gallons for each field color/type, three (3) gallons for trim and accent of each color/type.
 2. Store in location as directed by Owner.
 3. Ensure containers are sealed and identified by manufacturer, type, and color.
 4. Submit maintenance data under provisions of Section 01 7800 - Closeout Submittals.
 5. Include cleaning methods, and recommended cleaning solutions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements indicated herein, provide products of one of the listed manufacturers.
- B. Sherwin-Williams Co.: www.sherwin-williams.com.
- C. Kelly-Moore Paints: www.kelleymoore.com.
- D. PPG Paints: www.ppgpaints.com
- E. Benjamin Moore & Co.: www.benjaminmoore.com.
- F. TNEMEC Company Inc.: www.tnemec.com.
- G. Substitutions: Under provisions of Section 01 6000 - Product Requirements.

2.02 MATERIALS - GENERAL

- A. Paints and Coatings - General
 - 1. Unless otherwise indicated, provide factory-mixed coatings. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
 - 2. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
- B. Primers
 - 1. Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

2.03 COLOR SCHEDULES

- A. Color schedule in Section 01 6210 - Schedule of Materials and Colors.
- B. The Architect may select, allocate, and vary colors on different surfaces throughout the Work, subject to the following.
 - 1. Exterior work: A maximum of three (3) different colors will be used, with variations for trim, doors, miscellaneous work, and metal work.
 - 2. Interior work: A maximum of ten (10) different pigmented colors will be used, with variations for trim and wall surfaces and wainscots.
 - 3. Dark tones: A maximum of five (5) dark tones will be used as accent colors for interior.
- C. All painted graphics shown on the drawings shall be included in the base proposal and shall be included in this section. Contractor shall note that school colors and mascot may be released after initial color selection. Contractor shall make all necessary adjustments.

2.04 MISCELLANEOUS MATERIALS

- A. Coating Application Accessories
 - 1. Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required per manufacturer's specifications.

2.05 INTERIOR DRYWALL TEXTURING

- A. Interior drywall texturing compounds shall be equal to USG Tuf-Tex Wall and Ceiling Texture. Unless shown or otherwise indicated on the drawings, provide "Heavy Orange Peel or Spatter Finish" texture on walls or ceilings, as directed by Architect. Do not knockdown or drag texture.
- B. Mix 1 Gallon of latex paint with each 50 lbs. of texture.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Do not begin application of coatings until substrates have been properly prepared. Notify Architect of unsatisfactory conditions before proceeding
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Proceed with work only after conditions have been corrected, and approved by all parties, otherwise application of coatings will be considered as an acceptance of surface conditions.

3.02 PREPARATION

- A. Comply with provisions of Section 01 7000 - Execution and Closeout Requirements.
- B. The surface must be dry and in sound condition. Remove oil, dust, dirt, loose rust, peeling paint or other contamination to ensure good adhesion.
- C. Remove mildew before painting by washing with a solution of 1 part liquid household bleach and 3 parts of warm water. Apply the solution and scrub the mildewed area. Allow the solution to remain on the surface for 10 minutes. Rinse thoroughly with clean water and allow the surface to dry 48 hours before painting. Wear protective glasses or goggles, waterproof gloves, and protective clothing. Quickly wash off any of the mixture that comes in contact with your skin. Do not add detergents or ammonia to the bleach/water solution.
- D. No exterior painting should be done immediately after a rain, during foggy weather, when rain is predicted, or when the temperature is below 50°F, unless products are designed specifically for these conditions.
- E. Methods:
 - 1. Concrete Masonry Units
 - a. Remove all loose mortar and foreign material. Surface must be free of laitance, concrete dust, dirt, form release agents, moisture curing membranes, loose cement, and hardeners. Concrete and mortar must be cured at least 30 days at 75°F. The pH of the surface should be between 6 and 9, unless the products to be used are designed to be used in high pH environments such as Loxon. On tilt-up and poured-in-place concrete, commercial detergents and abrasive blasting may be necessary to prepare the surface. Fill bug holes, air pockets, and other voids with a cement patching compound.
 - 2. Concrete, SSPC-SP13 or NACE 6
 - a. This standard gives requirements for surface preparation of concrete by mechanical, chemical, or thermal methods prior to the application of bonded protective coating or lining systems. The requirements of this standard are applicable to all types of cementitious surfaces including cast-in-place concrete floors and walls, precast slabs, masonry walls, and shotcrete surfaces. An acceptable prepared concrete surface should be free of contaminants, laitance, loosely adhering concrete, and dust, and should provide a sound, uniform substrate suitable for the application of protective coating or lining systems.
 - 3. Drywall-Interior
 - a. Must be clean and dry. All nail heads must be set and spackled. Joints must be taped and covered with a joint compound. Spackled nail heads and tape joints must be sanded smooth and all dust removed prior to painting.
 - 4. Galvanized Metal
 - a. Clean per SSPC-SP1 using detergent and water or a degreasing cleaner to remove greases and oils. Apply a test area, priming as required. Allow the coating to dry at least one week before testing. If adhesion is poor, Brush Blast per SSPC-SP7 is necessary to remove these treatments.

5. Steel: Structural, Plate, Doors and Frames, etc.
 - a. Should be cleaned by one or more of the surface preparations described below. All metal shall be thoroughly prepared to ensure adhesion of new paint to the prepared surface. All prepared surfaces shall be observed and approved by the Owner or Owners Representative before new paint is applied.
 - b. Solvent Cleaning, SSPC-SP1
 - 1) Solvent cleaning is a method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants. Solvent cleaning does not remove rust or mill scale. Change rags and cleaning solution frequently so that deposits of oil and grease are not spread over additional areas in the cleaning process. Be sure to allow adequate ventilation.
 - c. Hand Tool Cleaning, SSPC-SP2
 - 1) Hand Tool Cleaning removes all loose mill scale, loose rust and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before hand tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.
 - d. Power Tool Cleaning, SSPC-SP3
 - 1) Power Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before power tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.
6. Stucco
 - a. Must be clean and free of any loose stucco. If recommended procedures for applying stucco are followed, and normal drying conditions prevail, the surface may be painted in 30 days. The pH of the surface should be between 6 and 9, unless the products to be used are designed to be used in high pH environments such as Loxon.
7. Wood-Exterior
 - a. Must be clean and dry. Prime and paint as soon as possible. Knots and pitch streaks must be scraped, sanded, and spot primed before a full priming coat is applied. Patch all nail holes and imperfections with a wood filler or putty and sand smooth.
8. Wood-Interior
 - a. All finishing lumber and flooring must be stored in dry, warm rooms to prevent absorption of moisture, shrinkage, and roughening of the wood. All surfaces must be sanded smooth, with the grain, never across it. Surface blemishes must be corrected and the area cleaned of dust before coating.

3.03 APPLICATION

- A. Comply with provisions of Section 01 7000 - Execution and Closeout Requirements.
 - B. Testing: Due to the wide variety of substrates, preparation methods, application methods and environments, one should test the product in an inconspicuous spot for adhesion and compatibility prior to full-scale application.
 - C. Apply all coatings and materials with manufacture specifications in mind. Mix and thin coatings according to manufacture recommendation.
 - D. Do not apply to wet or damp surfaces.
 1. Wait at least 30 days before applying to new concrete or masonry. Or follow manufactures procedures to apply appropriate coatings prior to 30 days.
 2. Test new concrete for moisture content.
 3. Wait until wood is fully dry after rain or morning fog or dew.
 4. Allow applied coats to dry before next coat is applied.
 - E. Apply coatings using methods recommended by manufacturer.
-

- F. Uniformly apply coatings without runs, drips, or sags, without brush marks, and with consistent sheen. Apply each coat of paint slightly darker than preceding coat unless specified otherwise.
- G. Apply coatings at spreading rate required to achieve the manufacturers recommended dry film thickness.
- H. Regardless of number of coats specified, apply as many coats as necessary for complete hide.
- I. Sand surfaces lightly between coats to achieve required finish.
- J. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- K. Where clear finishes are required, tint fillers to match wood. Work fillers into grain before set. Wipe excess from surface.
- L. Prime concealed surfaces of interior and exterior woodwork with primer paint.
- M. Prime concealed surfaces of interior wood surfaces scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with thinner.
- N. All drywall installation areas shall be made ready for painting by first preparing the gypsum wallboard surfaces with texturing as specified. Apply in strict compliance with manufacturer's written directions. Omit texturing where wall carpet occurs, reference Finish Schedule on drawings.
- O. At gymnasiums, contractor shall paint wood blocking for gym equipment supports to match adjacent color. Contractor shall coordinate the sequencing with all trades.
- P. Exterior Woodwork: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 2 weeks.
- Q. Miscellaneous surfaces and procedures
 1. Refer to mechanical and electrical standards for schedule of color coding and identification banding of equipment, duct work, piping, and conduit.
 2. Exposed mechanical items
 - a. Finish electric panels, access doors, conduits, pipes, ducts, grilles, registers, vents, and items of similar nature to match the adjacent wall and ceiling surfaces, or as directed.
 - b. Paint visible duct surfaces behind vents, registers, and grilles Sherwin Williams Pro Mar Flat Black.
 - c. Wash metal with solvent, prime, and apply two coats of alkyd enamel.
 3. Exposed pipe and duct insulation
 - a. Apply one coat of latex paint on insulation which has been primed under other Sections; apply two coats on such surfaces when unprepared.
 - b. Match color of adjacent surfaces.
 - c. Remove band before painting, and replace after painting.
 4. Hardware: Paint prime coated hardware to match adjacent surfaces.
 5. Wet areas
 - a. In toilet rooms and contiguous areas, add an approved fungicide to paints.
 6. Exposed vents: Apply two coats of heat-resistant paint approved by the Architect.
- R. Inspection: The coated surface must be inspected and approved by the architect just prior to each coat.
- S. Cleaning: Collect waste material which may constitute fire hazard, place in closed metal containers, and remove daily from site.

3.04 REPAIR/RESTORATION

- A. For surfaces that are to receive new finish, prepare surface and apply materials as described below and per manufacture recommendation.

- B. Preparation of Existing Surfaces That Have Been Previously Painted or Varnished:
1. The workmanship shall be best quality, and the surface shall be prepared in a thorough manner in order that the new finish shall be as finished as if the surface had been new with all the usual preparation for new paint or varnish.
 2. All previously painted or varnished surfaces or surfaces that have been previously finished in any manner shall first be prepared to receive new finish or any sort, according to the following specifications:
 - a. Existing painted sand finish plaster walls to be repainted
 - 1) Remove all scaled or loose paint.
 - 2) Fill all cracks in plaster as follows:
 - (a) Large cracks - caulk with latex sealant.
 - (b) Hairline cracks - Add 1 lb. of taping cement to 1 gallon of latex paint and brush across cracks until filled.
 - b. Existing enamel or varnished surfaces on smooth plaster or any surface
 - 1) Add 4 tablespoons of Tri-Sodium Phosphate per quart of paint thinner and wash surfaces to be repainted not less than 4 hours nor more than 7 hours before painting first coat.
 - c. Existing drywall partitions to receive new base.
 - 1) Upon removing existing rubber base, prepare wall surface to receive new base. Surface shall be leveled to meet adjacent surface. Texture wall as required to match existing.
- C. Painting Existing Surfaces after Surfaces Have Been Prepared
1. Sand Finish Plaster
 - a. One coat primer-sealer colored to match finish coat. Primer-sealer will be SW ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
 - b. One coat of paint shown on schedule or two coats if required to fully cover for first quality finish.
 2. Concrete Masonry Units
 - a. Same as sand finish plaster.
 3. Smooth Plaster Walls
 - a. One coat SW ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
 - b. Second coat will be as directed by the Architect.
 4. Varnished Surfaces to be Revarnished
 - a. Repair scratches with SW Wiping Stain, S64 series.
 5. Enameled Trim:
 - a. Apply one coat SW Premium Wall & Wood Primer, B28W8111.
 - b. Second coat will be as directed by the Architect.
 6. Hollow Metal Trim (Existing)
 - a. Same as enamel trim.
- D. Preparation and Painting of Existing Vinyl-Covered Gyp Board Walls
1. Remove all loose or delaminated vinyl and clean wall thoroughly.
 2. Fill joints with Caulk equal to Sherwin-Williams 1050 Quick Dry Siliconized Acrylic Latex Caulk.
 3. Float seam smooth with regular compound mud (no tape). Let dry.
 4. Float seam a second time with regular compound mud and fiberglass mesh tape. Let dry.
 5. Mix regular compound mud with Primer-Sealer. Roll on mix over the entire panel with ¾" nap roller. Let dry.
 6. Finish wall surface with primer coat and 2 finish coats as specified in Finish Code 110.

3.05 PROTECTION

- A. Protect finished coatings from damage until completion of project.
-

- B. Touch-up damaged coatings after substantial completion, following manufacturer's recommendation for touch up or repair of damaged coatings. Repair any defects that will hinder the performance of the coatings.

PART 4 - SCHEDULES

4.01 GENERAL

- A. The Painting Schedule of this Section is based, in general, on products of Sherwin-Williams Company (noted SW on the schedule).
- B. Where painting occurs in addition or renovation projects provide low odor finishes equal to Sherwin Williams ProMar 200 Zero VOC Series.
- C. The various surfaces and areas receiving finishes maybe indicated on the drawings or as noted below. The desired finishes are shown by code numbers. Not all codes listed below may be used. The required materials for each code number shown on the finish schedule are specified below under the corresponding code numbers.

4.02 PAINTING SCHEDULE

- A. Interior Surfaces
 - 1. Ferrous Metal
 - a. Primer – S/W DTM Bonding Primer (B66A00050)
 - b. Finish – S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series)
 - 2. Galvanized Metal
 - a. Primer – S/W DTM Bonding Primer (B66A00050)
 - b. Finish – S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series)
 - 3. Wood – Painted
 - a. Primer – S/W Premium Wall and Wood Primer (B28W8111)
 - b. Finish – S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series)
 - 4. Wood – Stain
 - a. Stain – S/W WoodClassic 250 Stains
 - b. Top Coat – S/W WoodClassics Waterborne Polyurethane Varnish Gloss (A68 Series)
 - c. Or
 - d. Top Coat – S/W WoodClassics Waterborne Polyurethane Varnish Satin (A68 Series)
 - 5. Gypsum Wallboard
 - a. Primer – S/W PVA Drywall Primer & Sealer (B28-8000 Series)
 - b. Finish – S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series)
 - 6. Gypsum Wallboard – Kitchens
 - a. Primer – S/W PVA Drywall Primer & Sealer (B28-8000 Series)
 - b. Finish – S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series)
 - 7. Concrete Masonry Units (CMU)
 - a. Primer – S/W Heavy Duty Block Filler (B42W46)
 - b. Finish – S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series)
 - 8. Concrete Masonry Units (CMU) – Kitchens
 - a. Primer – S/W Heavy Duty Block Filler (B42W46)
 - b. Finish – S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series)
 - 9. Concrete Floors
 - a. Primer – S/W ArmorSeal Floor Plex 7100 Primer (B70W / B70V)
 - b. Finish – S/W ArmorSeal 1K Waterbased Urethane Floor Enamel (B65-775 Series)
 - 10. Masonry/Concrete Ceilings
 - a. Primer – S/W Loxon Concrete & Masonry Primer Sealer (A24W8300)
 - b. Finish – S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-560 Series)
- B. Exterior Surfaces
 - 1. Ferrous Metal

- a. Primer - S/W DTM Bonding Primer (B66A00050)
 - b. Finish - S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series)
 2. Galvanized Metal
 - a. Primer - S/W DTM Bonding Primer (B66A00050)
 - b. Finish - S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series)
 3. Wood
 - a. Primer – S/W A-100 Latex Wood Primer (B42W41)
 - b. Finish – S/W A-100 Exterior Latex Satin (A8 Series)
 4. Concrete and CMU
 - a. Primer – S/W Loxon XP Waterproofing Coating (A24-1400 Series)
 - b. Finish - S/W Loxon XP Waterproofing Coating (A24-1400 Series)
 5. Fiber-Cement Material
 - a. Primer – S/W Loxon Concrete & Masonry Primer Sealer (A24W8300)
 - b. Finish – S/W A-100 Exterior Latex Satin (A8 Series)
 6. Parking Lot Lines
 - a. SetFast Acrylic Latex Traffic Marking Paint (TM21 Series)
 - b. Colors
 - 1) YELLOW for Parking Stripes
 - 2) RED for Fire Lanes with WHITE Lettering
 - 3) WHITE for Band Practice Field striping
 - 4) BLUE and WHITE for Handicap Parking symbols
- C. Additional Surfaces As Needed:
1. Code 114 - Green Screen Paint
 - a. 1st Coat: SW ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
 - b. 2nd/3rd Coat: Water Based Acrylic Chroma Key Matte Green Video Paint.
 2. Code 115a - Interior Drywall (Admin Area Walls and Ceilings/Bulkheads)
 - a. 1st Coat: SW ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
 - b. 2nd/3rd Coat: SW Pro Mar 200 Zero VOC Latex Eg-Shel, B20-2600 series.
 3. Code 115b - Interior Plaster (Standard Ceilings/Bulkheads)
 - a. 1st Coat: SW ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
 - b. 2nd/3rd Coat: SW Pro Mar 200 Zero VOC Latex Eg-Shel, B20-2600 series.
 4. Code 116a - Interior Drywall (Walls in Corridors and Student Areas)
 - a. 1st Coat: SW ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
 - b. 2nd/3rd Coat: SW Pro Mar 200 Zero VOC Latex Semi-gloss, B31-2600 series.
 5. Code 116b - Interior Plaster (High Humidity Ceilings)
 - a. 1st Coat: SW ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
 - b. 2nd/3rd Coat: SW Pre-Catalyzed Waterbased Epoxy Semi-Gloss, K46-150 series.
 6. Code 119 - Existing Metal Lockers - Electrostatic Enamel
 - a. Description: A single component modified acrylic enamel for use with electrostatic spray equipment.
 - b. Surface Preparation: Surface must be clean and free of oils, grease, loose paint, rust, polish, waxes and moisture. Sand and remove all ropes and runs on existing metal lockers. Surface must have feathering around scratches. Test surface for priming and adhesion to determine if a base coat should be removed and primed.
 - c. 1st/2nd Coat: Electrostatic Enamel Semi-Gloss (182 Line - Sumter Coatings, Inc. Sumter, SC)
 - d. Primer: As recommended by manufacturer for existing application.
 - e. Applicators
 - 1) Electro-Static Refinishers Inc., Dallas, TX; 972-296-2173
 - 2) ElectroCoat, Houston, TX; 800-508-9449

END OF SECTION

**SECTION 10 1100
VISUAL DISPLAY UNITS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Markerboards
- B. Tackboards

1.02 RELATED REQUIREMENTS

- A. Section 05 4000 - Cold-Formed Metal Framing.
- B. Section 06 1000 - Rough Carpentry: Blocking and supports.

1.03 REFERENCE STANDARDS

- A. ANSI A135.4 - Basic Hardboard; 2012 (Reaffirmed 2020).
- B. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling; 2018.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data on markerboard, tackboard, tackboard surface covering, trim, and accessories.
- C. Shop Drawings: Indicate wall elevations, dimensions, joint locations , special anchor details.
- D. Manufacturer's printed installation instructions.
- E. Maintenance Data: Include data on regular cleaning, stain removal .

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. American Visual Display Products: www.americanvisualdisplay.com.
- B. ASI Visual Display Products: www.asi-visualdisplayproducts.com.
- C. Claridge Products and Equipment, Inc: www.claridgeproducts.com/#sle.
- D. Ghent, a GMI Company: www.ghent.com/#sle.
- E. MooreCo, Inc: www.moorecoinc.com/#sle.
- F. Nelson Adams NACO: www.nelsonadamsnaco.com/#sle.
- G. Substitutions: See Section 01 6000 - Product Requirements.

2.02 VISUAL DISPLAY UNITS

- A. Markerboards: Porcelain enamel on steel, laminated to core.
 - 1. Basis of Design: Claridge LCS3 Series 1.
 - 2. Color: Low Gloss, White.
 - 3. Steel Face Sheet Thickness: 24 gage, 0.0239 inch .
 - 4. Core: MDF, 7/16 inch thick, laminated to face sheet.

5. Backing: Steel back, laminated to core.
 6. Size: As indicated on drawings.
 7. Frame: Extruded aluminum , with concealed fasteners.
 8. Frame Finish: Anodized, natural.
 9. Markerboard Finish: Markerboard surface shall be consistent in appearance without fading or ghosting.
 10. Accessories: Provide marker tray, map rail, flag holder, and metal display hooks at 2'-0" o.c. on map rail.
 11. Omit marker tray in all "Activity Rooms", "Exterior Applications" and "Gymnasiums."
- B. Tackboards: Fine-grained, homogeneous natural cork.
1. Acceptable Product: Claridge, Claridge Cork
 2. Cork Thickness: 1/4 inch.
 3. Color: As selected from manufacturer's full range.
 4. Backing: Hardboard, 1/4 inch thick, laminated to tack surface.
 5. Size: As indicated on drawings.
 6. Frame: Extruded aluminum , with concealed fasteners.
 7. Frame Finish: Anodized, natural.
- C. Combination Units and Units Made of More Than One Panel: Factory-assembled markerboards and tackboards in a single frame, of materials specified above.
1. Join panels of different construction with H-shaped extruded aluminum molding finished to match frame.
 2. Join panels of similar construction with butt joints, aligned and secured with steel spline concealed in edge of core.
 3. Configuration: As indicated on drawings.

2.03 MATERIALS

- A. Porcelain Enameled Steel Sheet: ASTM A424/A424M, Type I, Commercial Steel, with fired-on vitreous finish.
- B. Hardboard for Cores: ANSI A135.4, Class 1 - Tempered, S2S (smooth two sides).
- C. Medium Density Fiberboard (MDF): ANSI A208.2; composed of wood fibers pressure bonded with manufacturer's recommended adhesive to suit application.
- D. Steel Sheet Backing: 28 gage, 0.0149 inch, galvanized.
- E. Adhesives: Type used by manufacturer.

2.04 ACCESSORIES

- A. Map Rail: Extruded aluminum, manufacturer's standard profile, with cork insert and runners for accessories; 1 inch wide overall , full width of frame.
- B. Map Supports: Formed aluminum sliding hooks to fit map rail.
- C. (2) Flag Holders: Cast aluminum bored to receive 1 inch diameter flag staff, bracketed to fit top rail of board. Omit marker tray in all "Activity Rooms", "Corridors" "Exterior Applications" and "Gymnasiums."
- D. Marker Tray: Aluminum, manufacturer's standard profile, one piece full length of markerboard, molded ends, concealed fasteners, same finish as frame.
- E. Mounting Brackets: Concealed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated on shop drawings.

- B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as instructed by the manufacturer.

3.02 PREPARATION

- A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Install the work of this Section in strict accordance with the original design, the approved Shop Drawings, and the manufacturer's recommended installation procedures as approved by the Architect, anchoring all components firmly into position for long life under hard use, this includes wall anchors at 2'-0" o.c. and wall adhesive at maximum of 16" o.c.e.w.
- B. Install with top of the marker tray at 15-48 inches above finished floor. Verify actual height with Owner before installation as required to accommodate writing, projection and viewing surface.
- C. Secure units level and plumb.
- D. Butt Joints: Install with tight hairline joints.

3.04 CLEANING

- A. Clean board surfaces in accordance with manufacturer's instructions.
- B. Cover with protective cover, taped to frame.
- C. Remove temporary protective cover at Date of Substantial Completion.

END OF SECTION

**SECTION 10 1400
SIGNAGE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Room and door signs.

1.02 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. 2012 TAS - Texas Accessibility Standards; 2012.
- C. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- D. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Shop Drawings:
 - 1. Submit shop drawings showing each typical room and door sign type for fabrication, including typical drawings and details for each type to be provided.
 - 2. Submit shop drawings showing all graphic, wayfinding or other "special" signage for fabrication, including drawings and details for each to be provided.
 - 3. Shop drawings shall include plan location, directional information, size, font, color, mounting details, and scaled representation of configuration for each sign (included, but not limited to, building signs, directional/ wayfinding signs, and plaques) and graphic elements.
- D. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
 - 1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
 - 2. Request content of signs from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
 - 3. Submit for approval by Owner through Architect prior to fabrication.
- E. Building signage, including, but not limited to, directional/ wayfinding signs, plaques, graphic elements and marquee signs:
 - 1. ALL signage shall be submitted for approval by the Owner for content, color, size and other physical qualities.
 - 2. ALL signage shall not be fabricated or installed without the written approval of the Owner.
- F. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
- G. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
- H. Verification Samples: Submit samples showing colors specified.
- I. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of Section 01 6000 - Product Requirements.
- B. Package signs as required to prevent damage before installation.
- C. Package room and door signs in sequential order of installation, labeled by floor or building.
- D. Store tape adhesive at normal room temperature.

1.06 FIELD CONDITIONS

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain this minimum temperature during and after installation of signs.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Room and Door Signs:
 - 1. Apco Architectural Signs: www.apco.com
 - 2. ASI Signage: www.asisignage.com.
 - 3. Benchmark Signs: www.benchmarksigns.biz.
 - 4. Best Sign Systems, Inc.: www.bestsigns.com.
 - 5. Bayuk Graphic Systems, Inc.: www.bayukgraphics.com.
 - 6. Cosco Industries: www.coscoarchitecturalsigns.com.
 - 7. FASTSIGNS: www.fastsigns.com.
 - 8. Inpro: www.inprocorp.com.
 - 9. Kroy Sign Systems: www.kroysignsystems.com.
 - 10. Mohawk Sign Systems, Inc.: www.mohawksign.com.
 - 11. South Texas Graphic Specialties, Inc.: www.stxgraphics.com.
 - 12. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SIGNAGE APPLICATIONS

- A. Accessibility Compliance: Signs are required to comply with ADA Standards, 2012 TAS, ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
- B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
 - 1. Basis of Design: South Texas Graphic Specialties, Inc.
 - 2. Sign Type: Flat signs with sandblasted plastic panel media as specified.
 - a. Material to be 1/4" thick laminate with a melamine resin surface and a phenolic resin core. The material shall be NEMA rated and have flammability and smoke values that meet the standards for flammability of interior materials. Sign shall be of a one piece construction.
 - 3. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille. Glue-on letters or etched backgrounds are not acceptable.
 - 4. All text shall be accompanied by Grade 2 braille. Braille shall be separated 1/2" from the corresponding raised characters or symbols. Grade 2 braille translation to be provided by signage manufacturer.
 - 5. All letters, numbers and/or symbols shall contrast with their background. Characters and background shall have a non-glare finish.
 - 6. Character Color: As Selected.

7. Background color: As selected.
 8. Letterform shall be Helvetica Regular upper case letters and numbers.
 9. Size of letters and numbers shall be as follows:
 - a. Owners Room numbers shall be 1".
 - b. Lettering for room ID signs shall be 3/4" or as noted.
 - c. Provide construction floor plan room number in lower right hand corner on all signs. Number shall be 3/8" high and color shall match background.
 - d. Symbol size shall be 4".
 - e. Standard Grade 2 braille shall be 1/2" below copy.
 - f. Corners: Radiused edges.
 10. Provide solid cover plate for back side of sign where mounted to glass. Omit screw holes where glass mounted.
 11. Entry/Exit Numbering: Provide 4" high door number on each side of all exterior doors for First Responder information. Numbers shall start at main primary entry and continue sequence in clockwise direction around the building.
 12. Exterior Room Identification Signage
 - a. Provide cast aluminum sign with raised letters and border.
 - b. Raised letters and border shall be satin finish with painted background.
 - c. Signs shall be 6" x 6" with room function followed by Grade 2 Braille directly below.
 - d. Provide at all exterior mechanical, electrical, fire riser rooms or other exterior locations.
- C. Code Required Signage: Fire Protection and Utility Equipment Identification Access and Emergency Signage. See "Schedules" article below.

2.03 ACCESSORIES

- A. Countersunk Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.
- B. Tape Adhesive: Double sided tape and clear silicone adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
 1. Examine work area with installer present.
 2. If existing conditions are not as required to properly complete the work of this section, notify Architect.
 3. Do not proceed with installation until deficiencies in existing conditions have been corrected.
- B. Verify that dimensions, tolerances, and attachment methods for work in this section are properly coordinated with other work on site.

3.02 INSTALLATION

- A. Interior/Exterior Room and Door Signage
 1. Install in accordance with manufacturer's instructions.
 2. Install neatly, with horizontal edges level.
 3. Locate signs where indicated:
 - a. Room and Door Signs: Contractor shall locate specific mounting heights in coordination with the current TAS and ADA regulations. Mount sign on wall or glass.
 - b. If no location is indicated obtain Owner's instructions.
 - c. Wall or Glass Mounted: Double sided vinyl tape and clear silicone adhesive. Provide solid cover plate for back side of sign for glass installations.
 - d. Wall Mounted Directly to Masonry: Screw mount with four corner countersunk screws evenly spaced from each corner. Screw color to match sign color.

4. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

3.03 SCHEDULES

- A. Interior/Exterior Room and Door Signage:
 1. Type A - ID signs with room number with one window slot. Window insert shall be fixed.
 - a. Locations – Classrooms, offices.
 2. Type B - ID signs with room number and function.
 - a. Locations – All locations except classrooms, offices.
 - b. Provide "Roof Access" sign to rooms housing roof access hatch and ladder
 - c. Provide "Maximum Occupancy" signs at the following locations;
 - 1) Lecture Hall
 - 2) Cafeteria
 - 3) Auditorium
 - 4) Gymnasium
 - 5) Activity Room
 - d. Provide "Exterior Room Identification Signage" at all exterior mechanical, electrical and fire riser rooms.
 3. Type C - Restroom signs with 4" accessibility and gender symbol with the verbal description placed directly below and followed by Grade 2 braille.
 4. Type D - Pictogram signs with 4" accessibility and function symbol with the verbal description placed directly below and followed by Grade 2 braille.
 - a. Messages: Text will be room names as directed by the Architect.
 - b. Provide signage outside each assembly entrance stating "Assistive Listening Devices Available" with the international symbol of access for hearing loss.
 - c. Locations – Auditoriums, Distant Learning Rooms, Cafeterias, and Gymnasiums
- B. Code Required Signage.
 1. Fire Protection Equipment Identification, exterior access.
 - a. Location(s): Permanently installed and readily visible. Verify mounting location with AHJ.
 - 1) Fire Suppression Sprinkler Riser and Valve Rooms.
 - b. Copy: "RISER ROOM".
 - c. Color: Copy to be White in contrast to its Red background.
 2. Fire Protection and Utility Equipment Identification, interior access.
 - a. Location(s): Verify mounting location with AHJ.
 - 1) Air-Conditioning Systems Control Rooms.
 - 2) Fire Suppression Sprinkler Riser and Valve Rooms.
 - 3) Fire Detection, Suppression or Control.
 - b. Copy: For bidding purposes, use room name as indicated on drawings. Verify final copy with Architect prior to fabrication.
 - c. Color: Copy to be in contrast to its background.
 3. Elevator Lobby Emergency Signs: Provide one standardized design posted adjacent to each elevator call station on all floors. Copy: "IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT STAIRS".
 4. Raised Character and Braille Exit Signs: A sign stating "EXIT" in visual characters, raised characters and braille and complying with ICC A117.1 shall be provided adjacent to each door to an area of refuge, providing direct access to a stairway, an exterior area for assisted rescue, an exit stairway or ramp, an exit passageway and the exit discharge.

END OF SECTION

**SECTION 10 2239
FOLDING PANEL PARTITIONS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Top-supported folding panel partitions, horizontal opening.
- B. Ceiling track and operating hardware.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Wood blocking and track support shimming.
- B. Section 08 7100 - Door Hardware: Lock cylinders for panels

1.03 REFERENCE STANDARDS

- A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- C. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
- D. ASTM E413 - Classification for Rating Sound Insulation; 2016.
- E. ASTM E557 - Standard Guide for Architectural Design and Installation Practices for Sound Isolation Between Spaces Separated by Operable Partitions; 2012 (Reapproved 2020).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene at project site seven calendar days prior to scheduled beginning of construction activities of this section to review section requirements.
 - 1. Require attendance by representatives of installer.
 - 2. Notify Architect four calendar days in advance of scheduled meeting date.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on partition materials, operation, hardware and accessories, track switching components, and colors and finishes available.
- C. Shop Drawings: Indicate opening sizes, track layout, details of track and required supports, and stacking depth.
- D. Samples for Selection: Submit two samples of full manufacturer's color range for selection of colors.
- E. Samples for Review: Submit two samples of surface finish, 12 by 12 inches size, illustrating quality, colors selected, texture, and weight.
- F. Certificates: Certify that partition system meets or exceeds specified acoustic requirements.
- G. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention, and installation sequence.
- H. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods. Describe cleaning materials detrimental to finish surfaces and hardware finish.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified this section with minimum three years of documented experience.

- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until installation.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within two year period after Date of Substantial Completion.
- C. Provide two year manufacturer warranty against defects in material and workmanship, excluding abuse.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Folding Panel Partitions - Horizontal Opening:
 - 1. Kwik-Wall Company: www.kwik-wall.com/#sle.
 - 2. Moderco, Inc: www.moderco.com/#sle.
 - 3. Modernfold, a DORMA Group Company: www.modernfold.com/#sle.

2.02 FOLDING PANEL PARTITIONS - HORIZONTAL OPENING

- A. Folding Panel Partitions: Side opening; individual panels; side stacking; manually operated.
 - B. Panel Construction:
 - 1. Frame: 16 gauge, 0.0598 inch thick formed sheet steel frame top, bottom, jambs, and intermediates; welded construction.
 - 2. Substrate: Gypsum board.
 - 3. Panel Substrate Facing: Steel sheet, manufacturer's standard thickness.
 - 4. Hardware: Latching door handles of material, and finish to match remainder of project; lock cylinder keyed to building keying system.
 - a. Refer to Section 08 7100 for additional requirements.
 - b. Provide pass door with panic hardware where required per code - minimum 1 required.
 - 5. Panel Properties:
 - a. Thickness With Finish: 4 inches max.
 - b. Width: Standard width.
 - c. Weight: 5-11 lb/sq ft. based on STC rating.
 - C. Panel Finishes:
 - 1. Facing: Markerboard.
 - 2. Exposed Metal Trim: As scheduled in Section 01 6210.
 - D. Panel Seals:
 - 1. Panel to Panel Seals: Grooved and gasketed astragals, with continuous flexible ribbed vinyl seal fitted to panel edge construction; color to match panel finish.
 - 2. Acoustic Seals: Flexible acoustic seals at jambs, meeting mullions, ceilings, retractable floor and ceiling seals, and above track to structure acoustic seal.
 - E. Suspension System:
 - 1. Track: Formed steel; Minimum 1-1/4 by 1-1/4 inch size; thickness and profile designed to support loads, steel sub-channel and track connectors, and track switches.
 - 2. Carriers: Nylon wheels on trolley carrier at top of every second panel, sized to carry imposed loads, with threaded pendant bolt for vertical adjustment.
 - F. Performance:
 - 1. Acoustic Performance:
-

- a. Sound Transmission Class (STC): 48 to 52 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90, on panel size of 100 sq ft.
 2. Installed partition system track capable of supporting imposed loads, with maximum deflection of 1/360 of span.
- G. Accessories:
1. Pocket Enclosures where required: Door, frame, and trim to match adjacent panels. Reference plan for conditions.
 2. Pass Door: Single door, 36 inch wide by 84 inch high opening; same design and construction as panel; fit door with perimeter acoustic gaskets, concealed closer, and keyed lock.
 3. Acoustic Sealant: As recommended by partition manufacturer.

2.03 MATERIALS

- A. Aluminum Extrusions: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- B. Markerboard: Porcelain enamel on steel, laminated to core.
- C. Acoustic Insulation:
 1. Type: As required for acoustic performance indicated.
 2. Thickness: As required for acoustic performance indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated on shop drawings.
- B. Verify track supports are laterally braced and will permit track to be level within 1/4 inch of required position and parallel to the floor surface.
- C. Verify floor flatness of 1/8 inch in 10 feet, non-cumulative.
- D. Verify wall plumbness of 1/8 inch in 10 feet, non-cumulative.

3.02 INSTALLATION

- A. Install partition in accordance with manufacturer's instructions and ASTM E557.
- B. Fit and align partition assembly level and plumb.
- C. Lubricate moving components.
- D. Install acoustic sealant to achieve required acoustic performance.
- E. Coordinate electrical connections.

3.03 ADJUSTING

- A. Adjust partition assembly to provide smooth operation from stacked to full open position. Do not over-compress acoustic seals.
- B. Visually inspect partition in full extended position for light leaks to identify a potential acoustical leak.
- C. Adjust partition assembly to achieve lightproof seal.

3.04 CLEANING

- A. Clean finish surfaces and partition accessories.
- B. Condition markerboard surfaces in accordance with manufacturer's instructions.

3.05 CLOSEOUT ACTIVITIES

- A. Demonstrate operation of partition and identify potential operational problems.

END OF SECTION

SECTION 10 2600
WALL AND DOOR PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Corner guards.

1.02 RELATED REQUIREMENTS

- A. Section 09 2116 - Gypsum Board Assemblies: Placement of supports in stud wall construction.

1.03 REFERENCE STANDARDS

- A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010 (Reapproved 2018).
- B. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents; 2021.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- D. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies; 2014.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.
- C. Shop Drawings: Include plans, elevation, sections, and attachment details.
- D. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
 - 1. Submit two sections of corner guards, 6 inches long.
- E. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.
- F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- G. Maintenance Data: Manufacturer's instructions for care and cleaning of each type of product. Include information about both recommended and potentially detrimental cleaning materials and methods.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.
- B. Protect work from moisture damage.
- C. Protect work from UV light damage.
- D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.
- E. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Corner Guards:
 - 1. Babcock-Davis: www.babcockdavis.com/#sle.
 - 2. Construction Specialties, Inc: www.c-sgroup.com/#sle.
 - 3. Inpro: www.inprocorp.com/#sle.
 - 4. Koroseal Interior Products: www.koroseal.com/#sle.
 - 5. Nystrom, Inc: www.nystrom.com/#sle.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE CRITERIA

- A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.
- B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.

2.03 PRODUCT TYPES

- A. Corner Guards - Surface Mounted:
 - 1. Material: Polyethylene terephthalate (PET or PETG); PVC-free with full height extruded aluminum retainer.
 - 2. Performance: Resist lateral impact force of 100 lbs at any point without damage or permanent set.
 - 3. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 - 4. Width of Wings: 3 inches.
 - 5. Corner: Radiused.
 - 6. Color: As selected from manufacturer's standard colors.
 - 7. Length: One piece.
 - 8. Preformed end caps.
- B. Adhesives and Primers: As recommended by manufacturer.
- C. Mounting Brackets and Attachment Hardware: Appropriate to component and substrate.

2.04 FABRICATION

- A. Fabricate components with tight joints, corners and seams.
- B. Pre-drill holes for attachment.
- C. Form end trim closure by capping and finishing smooth.

2.05 SOURCE QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Provide wall and door protection systems of each type from a single source and manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.
- B. Verify that substrate surfaces for adhered items are clean and smooth.
- C. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.
- B. Position corner guard 4 inches above finished floor to 48 inches high or height as indicated on drawings.

3.03 TOLERANCES

- A. Maximum Variation From Required Height: 1/4 inch.
- B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

3.04 CLEANING

- A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

**SECTION 10 4400
FIRE PROTECTION SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguisher cabinets.
- B. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 01 4100 - Regulatory Requirements
- B. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 DEFINITIONS

- A. Where indicated on the Drawings, the abbreviation "F.E.C." defines a fire extinguisher and cabinet and the abbreviation "F.E." is for a fire extinguisher without a cabinet.

1.04 REFERENCE STANDARDS

- A. FM (AG) - FM Approval Guide; current edition.
- B. NFPA 10 - Standard for Portable Fire Extinguishers; 2017.
- C. UL (DIR) - Online Certifications Directory; Current Edition.
- D. International Fire Code.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher operational features, color and finish, and anchorage details.
- C. Shop Drawings: Indicate locations of cabinets, cabinet physical dimensions, rough-in measurements for recessed cabinets, locations of individual fire extinguishers, mounting measurements for wall bracket, installation procedures, and accessories required for complete installation.
- D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.
- G. Material and Safety Data Sheets for all mastics, glues, and adhesives and for insulating material for fire doors.

1.06 QUALITY ASSURANCE

- A. Single Source Responsibility: Obtain products in this Section from one manufacturer.
- B. Certifications
 - 1. Provide extinguishers which are U.L. listed and bear the U.L. "Listing Work" for type, rating, and classification.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of Section 01 6000 - Product Requirements.
- B. Store extinguishers in protected location until after final cleaning is completed.

1.08 FIELD CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

1.09 WARRANTY

- A. Comply with requirements of Section 01 7800 - Closeout Submittals.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Extinguishers and Cabinets and Accessories:
 - 1. JL Industries, Inc: www.jlindustries.com.
 - 2. Larsen's Manufacturing Co: www.larsensmfg.com.
 - 3. Potter-Roemer: www.potterroemer.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
 - 1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.
 - 2. UL Rating: 2A-10B:C, minimum.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
 - 1. Product: MP10 for all typical installations.
 - 2. Product: MP5 at Elevator Equipment Rooms and Science Labs.
 - 3. Class: A:B:C type.
 - 4. Size: 5 and 10 pound.
- C. Halotron I Type Fire Extinguishers: Stainless steel tank, with pressure gage.
 - 1. Product: HT5 at Computer Lab.
 - 2. Class: A:B:C type.
 - 3. Size: 5 pound.
- D. Wet Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gage.
 - 1. Product: WC-6L (6 liter capacity) at Kitchen (20 ft. away from hood).
 - 2. Class: K.
 - 3. Size: 1.6 gallons.

2.03 FIRE EXTINGUISHER CABINETS

- A. Cabinet Configuration: Semi-recessed type.
 - 1. Projected Trim: Returned to wall surface, with 2-1/2 inch projection, and 1 inch wide face.
- B. Door: 0.036 inch stainless steel, reinforced for flatness and rigidity with roller type catch. Hinge doors for 180 degree opening with continuous piano hinge. Provide solid doors at athletic and shop areas.
- C. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- D. Weld, fill, and grind components smooth.
- E. Finish of Cabinet Exterior Trim and Door: No. 4 - Brushed stainless steel.
- F. Finish of Cabinet Interior: White colored enamel.

2.04 ACCESSORIES

- A. Extinguisher Brackets: Formed steel, chrome-plated.
- B. If extinguisher is not located in a cabinet, provide bracket no. 860.
- C. Graphic Identification: Applied decal use vertical decal spelling.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings at locations shown on the Drawings. Install compliant with applicable accessibility requirements.
- C. Secure rigidly in place.
- D. Place extinguishers and accessories in cabinets.

END OF SECTION

**SECTION 10 5100
LOCKERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal lockers.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete base construction.
- B. Section 06 1000 - Rough Carpentry: Wood blocking and nailers.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data on locker construction, sizes and accessories.
- C. Shop Drawings: Indicate locker plan layout, numbering plan.
- D. Samples: Submit two samples 12 by 12 inches in size, of each color scheduled.
- E. Manufacturer's Installation Instructions: Indicate component installation assembly.
- F. Extra Stock Materials: 10 loose combination locks equal to Master Lock Company, with master key at back.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of Section 01 6000 - Product Requirements.
- B. Protect locker finish and adjacent surfaces from damage.

1.05 WARRANTY

- A. See Section 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide two year manufacturer warranty for repair or replacement of lockers that fail in material or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Lockers:
 - 1. Art Metal Products: www.artmetalproducts.com.
 - 2. Debourgh Manufacturing Co.: www.debourgh.com.
 - 3. Lyon Workspace Products: www.lyonworkspace.com.
 - 4. Penco Products, Inc: www.pencoproducts.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 LOCKER APPLICATIONS

- A. Size, type and quantity: Reference Drawings.

2.03 METAL LOCKERS

- A. All Lockers: Factory assembled, made of formed sheet steel, Cold-rolled mild steel, uncoated, stretcher leveled; metal edges finished smooth without burrs; baked enamel finished inside and out.
 - 1. Where ends or sides are exposed, provide flush panel closures.
 - 2. Provide filler strips where indicated, securely attached to lockers.
 - 3. Colors: Refer to Schedule of Materials and Colors.
- B. Assembly:
 - 1. Typical Lockers: All bolts and nuts shall be zinc plated and permanent shake-proof fastening.

- C. Typical Locker Body: Formed and flanged; with steel stiffener ribs.
 - 1. Body, Shelves, Tops and Trim: 16 gage, 0.0598 inch.
 - 2. Base: Reference drawings for base height and details
- D. Frames: Formed channel shape, welded and ground flush, welded to body, resilient gaskets and latching for quiet operation.
 - 1. Door Frame: 16 gage, 0.0598 inch, minimum.
 - 2. Provide ventilation slots in top and bottom of door frame.
- E. Doors: Hollow channel edge construction, 1 inch thick; welded construction, channel reinforced top and bottom with intermediate stiffener ribs, grind and finish edges smooth.
 - 1. Door Outer Face: 14 gage, 0.0747 inch, minimum.
 - 2. Form recess for operating handle and locking device.
 - 3. Ventilation Method for Typical Lockers: Provide ventilation slots in top and bottom of door.
- F. Hinges: Hinges shall be piano style continuous hinge.
- G. Coat Hooks: Stainless steel or zinc-plated steel.
 - 1. Two single prong wall hooks and one double prong back hook for all single, double, and triple tier lockers. For lockers over 42" high, provide one hat shelf. Lockers under 20" high are not equipped with hooks.
- H. Number Plates: Provide rectangular shaped aluminum plates. Form numbers 1/2 inch high of block font style, in contrasting color.
- I. Latching: Latching shall be achieved by securing a frame hook to the locker side frame located midway up on the door.
 - 1. Locking device shall be built-in lock. The padlock hasp shall be eliminated and the recessed pocket shall contain only the necessary punching to mount the lock. The frame hook shall have an interlocking finger oriented 90 degrees to the door edge to serve as a catch when padlocks are used and to resist prying when built-in locks are used. Equip each locker with a Master Lock model #1630/1636 built-in lock. Locking device shall be pre-locking so mechanism can be locked in open position, door locking automatically when closed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that prepared bases are in correct position and configuration.
- B. Verify bases and embedded anchors are properly sized.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install lockers plumb and square.
- C. Place and secure on prepared base.
- D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 lb.
- E. Bolt adjoining locker units together to provide rigid installation.
- F. Install end panels, filler panels, and sloped tops.
- G. Install accessories.
- H. Conceal fasteners on all face frames.
- I. Replace components that do not operate smoothly.

3.03 CLEANING

- A. Clean locker interiors and exterior surfaces.

END OF SECTION

**SECTION 10 5613
METAL STORAGE SHELVING**

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Work included: Provide metal storage shelving where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these specifications.

1.02 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.03 SUBMITTALS

- A. Comply with pertinent provisions of Section 01 3000 - Administrative Requirements.
- B. Product Data: Within 15 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section;
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements;
 - 3. Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.
 - 4. Samples of the proposed products, showing profiles joining, finish, and manufacturers full range of color.
 - 5. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.

1.04 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01 6000 - Product Requirements.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, manufacturer offering products that may be able to be included in the work include, but are not limited to the following:
 - 1. Penco Products, Inc., 800-562-1000 www.pencoproducts.com.

2.02 MATERIALS

- A. Cold Rolled Steel Sheet: ASTM A336/A 366M, matte finish, suitable for exposed applications, and stretcher leveled or roller leveled to stretcher level flatness.
- B. Galvanized Steel Sheet: ASTM A 653/A 653M, commercial quality, G60 (Z180) coating designation; mill phosphatized; suitable for exposed applications, and stretcher leveled or roller leveled to stretcher level flatness.

2.03 COMPONENTS - BOLTLESS SHELVING

- A. Boltless Shelving consists of simple components that lock rigidly together to form exceptionally strong shelving units. Equal to single rivet high density units as manufactured by Penco.
- B. Choose from a wide selection of component sizes and capacities to fit the storage requirements.

- C. ANGLE POST - 1-7/8" x 1-7/8": When maximum capacity and stability are essential, the heavy duty angle post is the proper choice. Ideally suited for two level shelving, storage deck and high rise shelving applications.
- D. TEE POST - 3-3/4" x 1-7/8" (Heavy Duty): Used in the same way as the standard tee, when increased load capacities are required.
- E. SINGLE RIVET SHELF BEAM (Heavy Duty): Manufactured to provide maximum capacity with very little loss of usable vertical space between shelves.
- F. DOUBLE RIVET ANGLE BEAM (Heavy Duty): Provides stability and increased load capacity in the longer lengths.
- G. DOUBLE RIVET CHANNEL BEAM: Designed to provide maximum left to right stability and higher capacity heavy duty beams.
- H. CENTER SUPPORT: Used with double rivet beams to provide front-to-rear support for shelf deck and provides added stability to beams.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install shelving level, plumb, rigid, and flush according to the manufacturer's written instructions.
- B. Connect groups of shelves together with standard fasteners
- C. Anchor shelves and walls at intervals recommended by the manufacturer, but not more than 36 inches o.c.
- D. Touch up marred finish, or replace units that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by the locker manufacturer.

END OF SECTION

**SECTION 10 7300
PROTECTIVE COVERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pre-engineered, free-standing, pre-finished extruded aluminum walkway covers.
- B. Pre-engineered, pre-finished extruded aluminum wall mounted hanging canopies.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete

1.03 REFERENCE STANDARDS

- A. AA ADM – Aluminum Design Manual; As Referenced in the International Building Code.
- B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.
- C. AAMA 612 - Voluntary Specification, Performance Requirements and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum; 2002.
- D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performance Organic Coatings on Aluminum Extrusions and Panels - American Architectural Manufacturers Association; 2011
- E. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 6000 Tensile Strength; 2010.
- F. ASTM A792/A792M - Steel Sheet, 55% Aluminum-Zinc Alloy Coated by Hot Dip Process; 2010.
- G. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2010.
- H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2012.
- I. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs; 2002 (Reapproved 2008).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Prior to commencement of fabrication, submit detailed shop drawings, showing all profiles, sections of all components, finishes, fastening details, and manufacturer's technical and descriptive data. Include field dimensions of openings and elevations on shop drawings.
- C. Design Data: Submit comprehensive structural analysis of design for the specified loads. Stamp and sign calculations by profession engineer.
- D. Shop drawing sheets that include engineering information designed by the Contractor's Delegated Design Engineer shall be signed and sealed in accordance with the Texas Engineering Practice Act. Sheets that do not provide information designed by the Contractor's Engineer do not require being signed and sealed. Calculation packages require a signed and sealed cover sheet only. Any submittals requiring to be signed and sealed that are received without the signature and seal will be rejected without review.
- E. Samples: 12 inches by 12 inches minimum illustrating design, workmanship and finish color.
- F. Designer Qualification Statement.
- G. Specimen Warranty: Furnish a copy of manufacturer's standard warranty.
- H. Installer Qualification Statement.

1.05 QUALITY ASSURANCE

- A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work licensed in Texas.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with no less than five years of documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section, and;
 - 1. With minimum five years of documented experience.
 - 2. Approved by manufacturer.
- D. Coordination: Coordinate work of this section with work of other sections which interface with covered walkway or canopy system (sidewalks, curbs, building fascias, etc.).

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to project site ready for erection.
- B. Package using methods that prevent damage during shipping and storage on site.
- C. Store materials under cover and elevated above grade.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a one-year period after date of Substantial Completion.
- C. Finish Warranty: Provide manufacturer's ten year warranty on factory finish against cracking, peeling, and blistering and two years for anodized finishes.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Protective Covers:
 - 1. AVAdek: www.avadek.com.
 - 2. Architectural Fabrication, Inc.: www.arch-fab.com.
 - 3. Aluminum Techniques Inc.: www.aluminumtechniques.com.
 - 4. Canopy Solutions, LLC: www.canopy-solutions.com.
 - 5. DITT-Deck, Dittmer: www.dittdeck.com.
 - 6. Peachtree Protective Covers: www.peachtreecovers.com.
 - 7. East Texas Canopy, Inc: www.easttexascanopy.com.
 - 8. Substitutions: See Section 01 6000 - Product Requirements.

2.02 WALKWAY COVERS

- A. Extruded Aluminum Walkway Cover shall consist entirely of extruded aluminum sections(roll-formed not acceptable). System shall consist of heli-arc welded, one-piece rigid structural bents (column and beam assemblies), decking, fascia, accessory items and hardware to provide a complete system.
 - 1. Configuration: As indicated on drawings with soffit panel.
 - 2. Sizes: As indicated on drawings.
 - 3. Design Criteria: Design and fabricate to resist loads without failure, damage, or permanent deflection as dictated by the applicable building code. Structure shall be capable of sustaining and supporting a concentrated load such as being walked upon.
 - a. For welded material, the tensile ultimate strength, "Ftuw", and tensile yield strength, "Ftyw", shall be used to determine available strength within weld-affected zone.
 - b. Design, fabrication, and erection of aluminum load-carrying structures, members, and connections shall be in accordance with AA ADM - Aluminum Design Manual; As Referenced in the International Building Code.

4. Finish: Class I Color Anodized Finish: AAMA 611 AA-M12C22A44 Electrolytically deposited colored anodic coating not less than 0.7 mils thick.
5. Provide a complete system ready for erection at project site.
6. Shop-fabricate to the greatest extent possible; disassemble if necessary for shipping.
7. The Contractor's Walkway Cover Engineer shall not bear on the existing building unless the Walkway Cover Engineer or another Structural Engineer hired by the Contractor evaluates the capacity of the existing structure to withstand loads that would be imposed by the walkway cover and either verifies that there is sufficient capacity or modifies the existing structure in a way that is approved by the Architect. If the covering is connected to the existing building, the Walkway Cover Engineer shall design the connection. For proposal purposes, the Contractor shall assume that it is not acceptable to bear on or attach to the existing building other than with flashing. The Contractor shall be permitted to submit alternative layouts of columns for consideration by the Architect if the alternative layout does not increase the cost of construction or the schedule.

B. Concrete Foundations

1. Where the foundations have been designed and detailed in the Structural Drawings, the Contractor's Walkway Cover Engineer shall design the attachment of the walkway cover to these foundations. The reactions shall not exceed the allowable values provided in the Structural Drawings. If no values are provided in the Drawings, the Contractor shall submit a request for information requesting this information from the Structural Engineer prior to the design and detailing of the Walkway Covers.
2. Where foundation design and detailing is not included in the Architectural or Structural Drawings, the foundation shall be designed by the Contractor's Walkway Cover Engineer in accordance with the following:
 - a. All foundations designed by the Walkway Cover Engineer shall be required to comply with the recommendations of the Geotechnical Engineer in the soil reports provided as part of this project manual.
 - b. If the Geotechnical Engineering report provided is not applicable to this project, the Contractor's Walkway Cover Engineer shall design the foundation to be consistent with the minimum requirements of the locally adopted version of the International Building Code. If the minimum requirements of the locally adopted version of the International Building Code require that a soil investigation be performed, the Contractor shall hire the Owner's Geotechnical Engineer at no additional cost to the Owner (including the cost for this work in the Contractor's proposal for the main contract to do this project) and it shall not be permitted to increase the construction schedule beyond the agreed upon schedule to perform the project which is to include the time it takes to have the soil report performed if necessary.
3. The Contractor shall have foundations designed and installed to accommodate existing conditions such as nearby existing foundations (which shall not be undermined) and overhead obstructions (which may require low-overhead pier drilling equipment).
4. Refer to Section 03 3000 - Cast-In-Place Concrete.
5. Sleeves (styrofoam blockout) shall be furnished by the walkway cover manufacturer and placed by the general contractor.

2.03 CANOPY SYSTEMS

- A. The Contractor's Canopy Engineer shall design the attachment of the canopies to the Structure. Where allowable reactions are provided on the Structural Drawings, the Contractor's Canopy Engineer shall design their attachments to not exceed these allowable reactions. Where no allowable reaction is provided, the Contractor's Canopy Engineer shall evaluate the Structure provided and limit reactions so as to not exceed its structural capacity or modify the existing structure in a way that is approved by the Architect. The Contractor shall be permitted to submit alternative configurations for consideration by the Architect if the alternative configurations do not increase the cost of construction or the schedule.

- B. Canopy: Shop fabricated, shop finished, extruded aluminum decking, (roll-formed not acceptable), outriggers, fascia and hanging rod assemblies free of defects impairing strength, durability or appearance.
 - 1. Configuration: As indicated on drawings with soffit panel.
 - 2. Sizes: As indicated on drawings.
 - 3. Design Criteria: Design and fabricate to resist loads without failure, damage, or permanent deflection as dictated by the applicable building code. Structure shall be capable of sustaining and supporting a concentrated load such as being walked upon.
 - a. For welded material, the tensile ultimate strength, "F_{tuw}", and tensile yield strength, "F_{tyw}", shall be used to determine available strength within weld-affected zone.
 - b. Design, fabrication, and erection of aluminum load-carrying structures, members, and connections shall be in accordance with AA ADM - Aluminum Design Manual; As Referenced in the International Building Code.
 - 4. Finish: Natural anodized, Class I AAMA 611 AA-M12C22A41 or AAMA 612 with electrolytically deposited organic seal; not less than 0.7 mils thick.
 - 5. Provide a complete system ready for erection at project site.
 - 6. Shop-fabricate to the greatest extent possible; disassemble if necessary for shipping.

2.04 MATERIALS

- A. Aluminum Extrusions: ASTM B209 or B 221.
- B. Aluminum Coated Steel Sheet: ASTM A792/A792M.
- C. Concealed Structural Supports: Aluminum, or steel coated for corrosion resistance and dissimilar metal isolation.
- D. Fasteners: ASTM F593 stainless steel or ASTM A 307 carbon steel.
 - 1. Deck Screws (rivets not permitted): Type 18-8 non-magnetic stainless steel sealed with a neoprene "O" ring beneath 5/8" outside dimension, conical washer.
 - 2. Fascia Rivets: Size 3/16" by 1/2" grip range aluminum rivets with aluminum mandrel.
 - 3. Bolts: All bolts, nuts and washers to be 18-8 non-magnetic stainless steel.
 - 4. Tek Screws: not permitted

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and site area for conditions that might prevent satisfactory installation.
- B. Verify that dimensions of supporting structure are within plus/minus 1/8 inch of dimensions shown on shop drawings.
- C. Verify that all adjacent painting, roofing, masonry work, and other work that might damage finish has been completed prior to installation of sun screens.
- D. Do not install until after all adjacent painting, roofing and masonry have been completed.
- E. Do not proceed with installation until all conditions are satisfactory.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's installation instructions.
- B. Set units level, plumb, with uniform joints, and aligned with building elements.
- C. Separate dissimilar metals using concealed bituminous paint or non-absorbent gasket.
- D. Anchor units to structure as indicated on the drawings.
- E. Do not cut or trim aluminum members without approval of manufacturer; do not install damaged members.
- F. Touch-up damaged finish coating using material provided by manufacturer to match original coating.

3.03 TOLERANCES

- A. Maximum Variation from Level/Plumb: Plus/Minus 1/8 inch.

3.04 CLEANING

- A. Clean exterior surfaces units of dust and debris; follow manufacturer's cleaning instructions for the finish used.

3.05 PROTECTION

- A. Protect units after installation to prevent damage due to other work until the Date of Substantial Completion.

END OF SECTION

**SECTION 11 6100
THEATRICAL LIGHTING SYSTEM**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Construction Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.
- B. TL series Drawings.

1.2 REFERENCES

- A. National Fire Protection Association (NFPA)
- B. National Electrical Code (NEC)
- C. American National Safety Institute (ANSI)
- D. Entertainment Services and Technology Association (ESTA)
- E. National Electrical Manufacturers Association (NEMA).
- F. TX State and City of Houston Building Code.

1.3 RESPONSIBILITY AND RELATED WORK

- A. The written specification and TL series drawings shall be collectively referred to herein as the Contract Documents.
- B. Contractor shall provide, based on the Contract Documents, a complete, turnkey system, tested and ready for acceptance testing. The Contract Documents are developed to the extent required to properly convey design intent and system infrastructure. It is understood by the contractor that they are to supply additional equipment, as required, to provide a complete and working system.
- C. System features or devices which are mentioned in one part of the Contract Documents may not be shown in the other. In case of conflict between the written specifications and the drawings, Contractor must seek clarification from the Consultant. If the Contractor fails to obtain such clarification, the interpretation of the Consultant will prevail.
- D. Contractor shall obtain all licenses and permits necessary for the execution of any work pertaining to the installation within this scope of work.
- E. Refer to TL0.00 for division of responsibilities related to the theatrical lighting system.

1.4 DEFINITION OF TERMS & ABBREVIATIONS:

- A. Provide: to supply and install.
- B. Furnish: to supply to another contractor for installation.
- C. Supply: to supply but not install.
- D. Install: to install but not supply.
- E. OFE: Owner furnished (supplied) equipment. Equipment will be provided to contractor for installation.
- F. NIC: Not In Contract. Refers to items that are not included in the scope of work outlined in this section but may be shown for coordination purposes or reference.
- G. Future: Equipment that will be provided by owner later. Accommodations shall be provided for future equipment as shown on the drawings.

1.5 SYSTEM DESCRIPTION

- A. The theatrical lighting system will use LED-based lighting fixtures where to reduce the operating cost and maintenance effort required to keep the system running.
- B. LIGHTING POWER AND CONTROLS
 - 1. Fixtures with integrated dimming capabilities will be used. No dimmer rack or portable dimmer packs will be provided. Non-dimmed power circuits will be distributed to the lighting positions that will accommodate these fixtures (LED or automated lights) as well as providing the opportunity for temporary portable dimmer packs to be used with conventional light fixtures if desired.

2. Controls for the theatrical lighting system will include:
 - a. A lighting control console with at least 2 DMX Universes (expandable to at least 4), sACN (lighting) network connectivity, and the ability to support a minimum of 1 touch screen monitors.
 - b. A stage manager's panel, with a touchscreen that can control basic theatrical lighting presets.
- C. LIGHTING INSTRUMENTS
 1. The lighting instrument package will include:
 - a. LED Ellipsoidals (beam angles TBD)
 - b. LED PARs
- D. LOOSE EQUIPMENT
 1. The loose equipment package will consist of:
 - a. DMX cables
 - b. Cat5e Ethernet cables with Ethercon connectors
 - c. 20A Powercon extension cables
 - d. Powercon to SPG adapters

1.6 PRE-BID SUBMITTALS

- A. Comply with all requirements of Division 1.
- B. Bid Clarifications. Contractor is responsible for reading and understanding all information presented in these specifications and related documents outlined in Section 1. Discrepancies between drawings and specifications or other errors or omissions should be brought to the Consultant's attention a minimum of 5 days prior to bid date. Failure to do so does not relieve the contractor from the requirement to provide a fully operational and turnkey system. In this event, the Contractor agrees to abide by the decision of the Consultant for resolution.
- C. Contractor Qualifications. Contractors will be considered by the Owner and Consultant upon receipt of qualifications as outlined in Bid Submittals section below.

1.7 BID SUBMITTALS

- A. Comply with all requirements of Division 1.
- B. Submit according to conditions of the Construction Contract and Project Manual.
- C. Bidders that have not been pre-qualified shall submit the following information:
 1. Company profile including history, number of employees, facility size and completed projects.
 2. Installer shall have previously installed at least three jobs of similar magnitude, completed within the last five years. A resume shall be provided for these projects including project name, scope of services, year completed, and contact information for a reference. Provide at least one such completed job for inspection by the Architect and/or consultant.
 3. Installer shall have five years of experience with equipment and systems of the types specified, shall maintain a fully staffed and equipped service facility, and shall be a franchised dealer and authorized service facility for the major brands specified, and shall be properly licensed to work in Houston, TX
 4. Resume of key personnel to be used on this project, including but not limited to: Project Manager; Lead Engineer; Job-Site Superintendent.
 5. A sample set of shop drawings or as-built documents that confirm the Contractor's capabilities to provide engineering and documentation for the project.
 6. A line sheet listing all manufacturers the Contractor is a dealer and/or authorized service center for.
 7. A description of the Contractor's abilities for in-shop assembly, fabrication, and testing.
- D. The Bidder shall disclose in the bid whether any portions of the project work will be subcontracted out. All terms of this contract, including bidding and qualification statements, shall apply to the subcontractor. Provide the following information for each subcontractor to be used:

1. Name of the proposed subcontractor.
 2. A statement of qualifications for each subcontractor.
 3. A scope of work outlining what portions of the project for which the subcontractor will be responsible.
- E. Include the following information with the bid submittal:
1. The total contract price.
 2. The total price for any add or deduct alternates.
 3. The price for contractor tests and adjustments as outlined in Section 3.3.
 4. An itemized equipment list.
 5. Unit pricing for all equipment listed above.
 6. A breakdown of the number of labor hours for each of the following:
 - a. Engineering and documentation.
 - b. On site coordination meetings and supervision.
 - c. In shop fabrication and assembly.
 - d. On site fabrication, assembly, and installation.
 - e. On site verification and testing.
- F. Substitutions. Contractor shall note all substitutions at the time of bid. Any proposed substitutions must meet all specifications of the specified equipment. No product substitution will be accepted without the written approval of the Consultant or Owner. Consultant and owner retain the right to reject any proposed substitution.
- G. Contractor to obtain all licenses and permits necessary for the execution of any work pertaining to the installation, or any operation by the Owner.

1.8 PROJECT SUBMITTALS

- A. Comply with all requirements of Division 1.
- B. Submit according to conditions of the Construction Contract and Project Manual.
- C. Make each specified submittal as a coordinated package complete with all information. Uncoordinated sets will be returned without review.
- D. Product Data: Submit within 30 days of contract award. Submit manufacturer's product data sheets for each item of equipment that will be provided as part of this contract. Submit electronically as a single PDF. All equipment cut sheets will be arranged per specification section number. Provide a table of contents and a bookmark at the start of every product sheet.
- E. Shop Drawings
 1. Submit within 60 days of contract award.
 - a. Failure to submit shop drawings with ample time for evaluation shall not entitle the contractor to an extension of contract time.
 - b. There will be no work authorized on site without the prior submittal (and subsequent approval) of a complete set of shop drawings. Any exceptions to this must be in writing and approved by the Consultant.
 - c. Review of shop drawings is for general conformance with the design intent and general compliance with the contract documents of the project. Corrections, comments or markings made do not relieve the Contractor from compliance with the Contract Documents nor allow departure there from. Contractor remains responsible for detailing and accuracy, confirming and correlating quantities and dimensions, selecting fabrication processing and techniques of construction, coordinating work with that of other trades, and performing work in a safe a satisfactory manner.
 2. Submitted as a multi-sheet PDF document with:
 - a. Minimum 11" x 17" sheets
 - b. Table of Contents.
 - c. Bookmarks for every sheet with Sheet Name and Number
 3. Drawings shall be a standalone package containing all information required for system installation. The package shall include:
 - a. A legend of all symbols and abbreviations used in the drawing package

- b. Plan View Drawings showing:
 - 1) Locations of all equipment and devices
 - 2) Locations of junction boxes, with associated conduits and cable fill
 - 3) Coordinated layouts of:
 - a) Equipment Rooms
 - b) Control Booths
 - c) Follow Spot Booths
 4. Section and Elevation Drawings including but not limited to:
 - a. Lighting fixture hang positions
 5. Equipment Rack Elevations including:
 - a. Location of all equipment within the rack
 - b. Heat loads for each equipment rack and calculations showing how numbers were derived
 6. AC Power Requirements
 - a. For each equipment rack show:
 - 1) Power requirements and calculations showing how numbers were derived
 - 2) Power distribution details within each rack
 7. Rigging Detail Drawings
 - a. Details will be submitted with licensed engineer stamp licensed in the state in which the project resides.
 - b. Drawings will include:
 - 1) Structural attachment details
 - 2) Welding calculations
 - 3) Types of hardware to be used
 8. Wiring Schematics
 - a. Complete and detailed wiring schematic for all systems including:
 - 1) Cable types
 - 2) Identification by number and color codes
 - 3) Detailed wiring of connections to equipment and between equipment racks
 9. Schematic drawings of any custom circuitry or equipment modifications, including connector pin-outs and component lists.
- F. Schedules showing:
1. Cable Types
 - a. Type Identifier matching Contract Documents
 - b. Manufacturer
 - c. Part Number
 - d. Signal Group
 - e. Nominal Outside Diameter
 2. Junction Boxes
 - a. Box Name
 - b. Drawing Reference
 - c. Location
 - d. Dimensions
 - e. Mounting Height
 3. Pull Schedule
 - a. Pull Length
 - b. Source and Destination
 - c. Wire Number
 4. Custom Color and Finishes for:
 - a. Fixtures
 - b. Custom Panels
 - c. Exposed Cabling
 5. Conduit riser diagram showing interconnect of all systems

6. Terminal strip layouts for all terminal strips to be used in junction boxes or equipment racks
 7. Connector wiring details including connector model numbers
 8. Network schematic showing:
 - a. Logical Connections of all devices
 - b. IP address scheme
 - c. VLAN Scheme
 9. Custom Panel Details including:
 - a. Materials
 - b. Finishes
 - c. Dimensions
 - d. Connector Layout
 - e. Connector Labeling
 10. Lighting patch bay layouts and labeling scheme
 11. Mounting and orientation details for:
 - a. Access points
 - b. Wireless antenna
 12. Relay panel physical and electrical details
 13. Control systems physical and electrical details
 14. Distribution devices physical and electrical details
- G. Final Inspection Notification Report- Two copies of a computer-generated checkout report for the entire system will be prepared and submitted two weeks prior to system commissioning. It will include:
1. A complete listing of every piece of equipment including serial number, the date it was tested and by whom, the results and (if failure occurred during any previous tests) the date retested
 2. The final report will indicate that every device tested successfully.
 3. A performance test report indicating that the system meets all of the Contractor testing requirements in Section 3.3 and 3.5.
 4. A copy of the Final Inspection Report shall be included in the Project Manual.

1.9 CONTRACT CLOSEOUT SUBMITTALS

- A. Comply with all requirements of Division 1.
 1. Submit all contract closeout documentation within 30 days after substantial completion, unless otherwise noted. Documents should be contained on a single USB Drive.
- B. Contractor shall work from approved shop drawings only. Note changes made during installation on a single set of drawings. This set of marked up drawings will not leave the jobsite until after the final system commissioning. Submit one corrected set of reproducible drawings showing work as installed. All “as-built” drawings to be provided in electronic form (ACAD 2010 or later and PDF).
- C. Contractor to provide a Project Manual prior to acceptance testing. Provide one electronic copy (PDF). This manual shall contain the following information:
 1. Table of Contents.
 2. A legend of acronyms and abbreviations must accompany all documentation.
 3. Contractor’s contact information for warranty and or service.
 4. A complete list of equipment, both installed and loose gear. Include manufacturer, model number, and serial number for all devices. Include settings (software or hardware settings) for any devices that required modification or adjustment during the acceptance testing.
 5. Operating manuals for each device.
 6. Service manuals for each device.
 7. Documentation of all testing results as outlined in Section 3.3 and 3.5
 8. Replacement parts lists of major items of equipment.
 9. Suggested schedule of routine maintenance. Schedule should include dates such as of replacement of all batteries, cleaning of air filters etc.

10. System Operation and Instructions- Prepare a complete and typical procedure for the operation of the equipment as a system, organized by subsystem or activity. This procedure should describe the operation of all system capabilities. Assume the intended reader of the manual to be unfamiliar with both the equipment and this facility.
11. A list of all equipment, indicating manufacturer, model, serial number, and equipment location (i.e. panel/rack/room number). Update following acceptance testing, if changed.
12. As-Built drawings to include the following:
 - a. Updated lighting hang plot with circuit numbering and control addressing.
 - b. Lighting distribution plot.
 - c. Updated instrument schedule and hook up sheets.
- D. Software Licensing and Manuals. Provide backup computer discs, all software manuals and license certificates for all software loaded on all PC's. Include all original software installed, or downloaded, to devices in the system as part of the USB Drive.
- E. Asbestos and PCB Certification: After completion of installation, but prior to Substantial Completion, Contractor will certify in writing that products and materials installed, and processes used, do not contain asbestos or polychlorinated biphenyls (PCB).

1.10 DELIVERY, HANDLING, STORAGE

- A. Comply with Division 1 General Conditions.

1.11 CODE COMPLIANCE

- A. All work and materials shall comply with all applicable codes and regulations to meet or exceed Federal, State, City, and Local Building Codes and Regulations. Advise the Architect if anything in the Plans or Specifications is out of compliance with codes and/or laws prior to bidding.

1.12 PROJECT CONDITIONS

- A. Verify conditions on the job site applicable to this work. Notify the General Contractor in writing of discrepancies, conflicts, or omissions promptly upon discovery.
- B. The drawings diagrammatically show cabling, conduit, wiring, and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install work as shown, recommend solutions and/or submit drawings to the Consultant for approval, showing how the work may be installed.

1.13 WARRANTY

- A. Installer shall warrant equipment to be free of defects in materials and workmanship for not less than one year after date of Substantial Completion. Defects occurring in labor or materials within one-year warranty shall be rectified by replacement or repair. Within the warranty period, provide answer to service calls and requests for information within a 24-hour period, and repair or replace any faulty item within a 72-hour period without charge, including parts and labor.
- B. This warranty shall not include any consumable items (eg. patterns).
- C. This warranty shall not void specific warranties issued by manufacturers for greater periods of time. Nor shall it void any rights guaranteed to the Owner by law.
- D. Theatrical Lighting Contractor to provide Owner with exact beginning and ending dates of the warranty period. Include the name of the person to call for service and telephone number. This information to be part of Project Record Drawings.

PART 2 - PRODUCTS

2.1 UNAUTHORISED MATERIALS

- A. Materials and products required for work of this section shall not contain asbestos, polychlorinated biphenyls (PCB) or other hazardous materials identified by the General Contractor or Owner.

- B. All devices shall have applicable approvals from a Nationally Recognized Testing Laboratory and meet all applicable local codes and requirements. Should any equipment lack proper approval the Contractor will arrange for onsite inspections and certification at no additional expense to the Owner.

2.2 ACCEPTABLE MANUFACTURERS

- A. Model numbers and manufacturers included in this specification are listed as a standard of quality.
- B. Consultant will consider other qualified manufacturers subject to review. Submit according to conditions of the Construction Contract and Project Manual.
- C. Proposed substitutions must meet all specifications of the specified equipment. The Contractor will supply complete technical data specifications at the time of proposed substitution.
- D. The Contractor will arrange for product demo at the request of the Consultant or Owner Representative and will pay ground freight shipping to and from site, or to and from Consultant's office.
- E. No product substitution will be accepted without the written approval of the Consultant and Owner. The Owner, General Contractor, and the Consultant reserve the right to accept or refuse any substitution without condition.
- F. Upon acceptance of a substitution, Contractor assumes all responsibility for verification and coordination of all heat, power, rack space and architectural requirements.
- G. If product is discontinued and/or no longer publicly advertised as a part of a manufacturer's current product line-up at time of installation, the project team reserves the right to request a substitution of product for new and currently offered product of like function fulfilling the design intent. Substitution value will be based on fair market value of original product at time of bid.

2.3 GENERAL

- A. Equipment and materials shall be new, meet the latest published specifications of that product, and conform to applicable regulatory provisions. Take care during installation to prevent scratches, dents, chips, etc.
- B. Theatrical Lighting Contractor shall verify all site conditions prior to fabrication and installation of all equipment. Notify Consultant of any discrepancies in site conditions or design documents as soon as identified.
- C. Wiring of power distribution cable shall be in accordance with the electrical engineer's specification.
- D. Wiring of control distribution cable shall be in accordance with the manufacturer's specification.
- E. Installation of theatrical lighting support pipes shall be in accordance with the structural engineer's specification.
- F. All products and materials to be handled and shipped in accordance with manufacturer's recommendation.
- G. Provide protective covering on equipment and furniture during construction to prevent damage or entrance of foreign matter.
- H. Replace at no expense to Owner, product damaged during delivery, storage, handling or construction.

2.4 RANCH HS AUDITORIUM - THEATRICAL LIGHTING SYSTEM

- A. Lighting Control Console (Quantity: 1)
 - 1. ETC Ion Xe 20 with 12,288 outputs
 - 2. Provide two (2) 27" Touchscreen Monitor with Black Bezel and minimum 1920 x 1080 resolution.
 - 3. Provide one (1) appropriately sized Desktop UPS device (No cooling fans).
 - 4. Provide one (1) 15' Cat 5e Network Patch Cable
- B. DMX Rack Mount 4-Port Node (Quantity: 6)
 - 1. ETC Response Mk2 4-Port-Terminal

2. Provide with Gateway Rack Mount Kit.
 3. Provide with all necessary patch cables to interface with lighting network.
 4. Units shall be mounted in racks A.LER.01 and A.LER.02.
- C. DMX Portable Two Port Node (Quantity:6)
1. ETC Response Mk2 RSN-DMX2-0-P
 2. Provide node mounted in back box with clamp for portable hanging.
 3. Provide node with 7.5 foot Network patch cable.
 4. Portable node shall be powered via Ethernet.
 5. Color to be Black.
- D. Network Patch Panel (Quantity: 4)
1. Provide Bittree or approved equivalent.
 2. Provide appropriately sized network patch panel.
 3. Provide as standard rack mountable unit.
 4. Patch panels shall be located in racks A.LER.01 and A.LER.02.
- E. Single Space Brush Panel (Quantity: 6)
1. Provide Middle Atlantic BR1 or approved equivalent.
- F. Network POE Switch (Quantity: 2)
1. CISCO CBS350-24P or approved equivalent
 2. Provide as standard rack mountable unit.
 3. Switches shall be located in racks A.LER.01 and A.LER.02.
- G. Wall Mounted Network Switch (Quantity: 1)
1. ETC Simple Network Box SNB8FP or approved equivalent.
 2. Box is labelled as A.LER.03.
- H. Lighting Console Interface Panel NET/NET/NET (Quantity: 2)
1. ETC or approved equivalent.
 2. Panel labeled as A.LWP.01 & 02.
 3. Provide these as flush wall plates w/Ethercon receptacles mountable in existing backboxes.
- I. NET Plug In Ethercon Panel (Quantity: 7)
1. ETC or approved equivalent.
 2. Provide this as a flush wall plate w/Ethercon receptacle mountable in either existing or new backbox locations.
 3. Panels labelled as A.LWP.03 thru 06 and A.LPB.01 thru 03.
- J. NET Plug In Pipe Mount Ethercon Box (Quantity: 4)
1. ETC or approved equivalent.
 2. Provide this as single receptacle u-bolt pipe mount box w/Ethercon receptacle.
 3. Panels labelled as A.LPB.04 thru 07.
- K. Dimmer Rack Renovation (Quantity: 2)
1. Provide ETC Sensor SR48 Rack Power Package upgrade w/5 year warranty.
- L. Dimmer Rack Renovation (Quantity: 1)
1. Provide ETC Sensor SR12 Rack Power Package upgrade w/5 year warranty.
- M. Theatrical Lighting DMX/NET Relay Rack, 24 space (Quantity: 1)
1. ETC ECHO Pass through
 2. Provide with twenty-four (24) 20A single pole relays.
- N. Ellipsoidal Theatrical Lighting Instrument (Quantity: 66)
1. ETC ColorSource Spot V w/shutter assembly or approved equivalent.
 - a. 19° - 28
 - b. 26° - 14
 - c. 36° - 20
 - d. 50° - 4
 2. Provide complete with c-clamp, gel frame, safety cable and 3' lead terminated to a L5-20 plug.
 3. Refer to Theatrical Lighting Plan for hang and focus details.

- O. Fresnel Theatrical Lighting Instrument (Quantity: 27)
 - 1. ETC ColorSource Fresnel V or approved equivalent.
 - 2. Provide complete with c-clamp, gel frame, safety cable and 3' lead terminated to a L5-20 plug.
 - 3. Refer to Theatrical Lighting Plan for hang and focus details.
- P. Cyc Theatrical Lighting Instrument (Quantity: 18)
 - 1. ETC ColorSource Cyc or approved equivalent.
 - 2. Provide complete with c-clamp, gel frame, safety cable and 3' lead terminated to a L5-20 plug.
 - 3. Refer to Theatrical Lighting Plan for hang and focus details.
- Q. PARnel Theatrical Lighting Instrument (Quantity: 22)
 - 1. ETC Source4WRD II retrofit kit and Source4WRD PARnel fixture body or approved equivalent.
 - 2. Provide complete with c-clamp, gel frame, safety cable and 3' lead terminated to a L5-20 plug.
 - 3. Refer to Theatrical Lighting Plan for hang and focus details.
- R. Linear Theatrical Lighting Instrument (Quantity: 5)
 - 1. ETC ColorSource Linear 2 or approved equivalent.
 - 2. Provide complete with c-clamp, floor trunion, gel frame, safety cable and 3' lead terminated to a L5-20 plug.
 - 3. Refer to Theatrical Lighting Plan for hang and focus details.
- S. LED Followspot (Quantity: 2)
 - 1. Canto Aurora X1 Short or approved equivalent.
 - 2. Provide complete with floor stand and 15' power cord terminated to a NEMA 5-15P.
- T. DMX Extension Cable (Quantity: 150)
 - 1. 5' – 5
 - 2. 10' – 5
 - 3. 15' – 140
 - 4. Cables shall be labeled for length using appropriately sized self-adhesive numbers 3" from both connector ends covered by clear heat shrink tubing.
 - 5. Cables shall be supplied with one (1) appropriately sized Velcro cable tie.
 - 6. Cables shall be black.
 - 7. Cable shall be constructed according to USITT DMX512/1990 standard.
 - 8. Cables shall be constructed with one (1) 5 pin XLR Male connector and one (1) 5 pin XLR Female connector.
- U. 20A PowerCon TRUE1 Extension Cable (Quantity: 150)
 - 1. 5' – 5
 - 2. 10' – 5
 - 3. 15' – 140
 - 4. Cables shall be labeled for length using appropriately sized self-adhesive numbers 3" from both connector ends covered by clear heat shrink tubing.
 - 5. Cables shall be supplied with one (1) appropriately sized Velcro cable tie.
 - 6. Cables shall be black.
 - 7. Cable shall be constructed using 12/3 SJOO-W cable.
 - 8. Cables shall be constructed with PowerCon TRUE1 connectors rated for 120vac @ 20amp loads.
- V. RJ45 to 5-Pin Female Connector (Quantity: 12)
- W. 3' Molded Cat6 Patch Cable (Quantity: 64)
- X. Color Media:
 - 1. Provide a color media allowance for 12 – 20" x 24" sheets of R119.

2.5 RANCH HS AUDITORIUM - ARCHITECTURAL LIGHTING CONTROL SYSTEM

- A. Architectural Control Rack (Quantity: 1)
-

1. ETC Unison ERn2-RM
2. Provide with one (1) P-ACP architectural control processor.
3. Provide with one (1) P-SPM-E Station Power Module.
4. Unit shall be mounted in rack A.LER.01.
- B. Architectural LCD Touchscreen Station (Quantity: 1)
 1. ETC Unison P-TS7-PE
 2. Provide with portable desktop stand 95622.
 3. Provide Station with 25' cable.
 4. Confirm color with architect.
- C. Architectural LCD Rack Mount Touchscreen Station (Quantity: 1)
 1. ETC Unison P-TS7-PE
 2. Provide with rack mount plate.
 3. Color to be black.
- D. Architectural Entry Station (Quantity: 6)
 1. ETC Unison UH10005-_1F.
 2. Confirm color with architect.
- E. Architectural Entry Station (Quantity: 2)
 1. ETC Unison UH10002-_1F
 2. Confirm color with architect.
- F. Architectural Entry Station (Quantity: 2)
 1. ETC Unison UH10002-_1F with custom coverplate for existing back boxes.
 2. Confirm color with architect.
- G. Architectural Entry Station (Quantity: 3)
 1. ETC Unison UH40604-_1P with custom coverplate for existing back boxes.
 2. Confirm color with architect.
- H. Emergency Bypass Detection Kit (Quantity: 1)
 1. ETC Emergency Bypass Detection Kit EBDK
- I. Emergency Bypass DMX Controller (Quantity: 1)
 1. ETC DMX Emergency Bypass Controller DEBC-6

2.6 RANCH HS BLACK BOX – THEATRICAL LIGHTING SYSTEM

- A. Lighting Control Console (Quantity: 1)
 1. ETC Ion Xe 20 with 2,048 outputs
 2. Provide two (2) 27" Touchscreen Monitor with Black Bezel and minimum 1920 x 1080 resolution.
 3. Provide one (1) appropriately sized Desktop UPS device (No cooling fans).
 4. Provide one (1) 15' Cat 5e Network Patch Cable
- B. Equipment Racks Wall Mounted (Quantity: 1)
 1. MIDDLE ATLANTIC DWR series 22" Deep Racks
 2. Provide appropriately sized rack for equipment listed in this spec as being located within the rack.
 3. Provide rack with sufficient horizontal cable managers to separate all switches and patch bays with one cable manager each. PANDUIT WMPF1E or approved equivalent.
 4. Provide rack with appropriately sized blank filler panels to close all unused rack spaces.
 5. Provide rack with sufficient and appropriately sized hook and loop fastener cable ties to neatly dress all patch cables for the lighting network.
 6. Provide rack with appropriately sized rack mount UPS to power all equipment located in the rack.
 7. Rack is labelled as BB.LER.01
- C. DMX Rack Mount 4-Port Node (Quantity: 1)
 1. ETC Response Mk2 4-Port-Terminal
 2. Provide with Gateway Rack Mount Kit.
 3. Provide with all necessary patch cables to interface with lighting network.

4. Unit shall be mounted in rack BB.LER.01.
- D. Network Patch Panel (Quantity: 2)
 1. Provide Bittree or approved equivalent.
 2. Provide appropriately sized network patch panel.
 3. Provide as standard rack mountable unit.
 4. Patch panels shall be located in racks BB.LER.01.
- E. Single Space Brush Panel (Quantity: 3)
 1. Provide Middle Atlantic BR1 or approved equivalent.
- F. Network POE Switch (Quantity: 1)
 1. CISCO CBS350-24P or approved equivalent
 2. Provide as standard rack mountable unit.
 3. Switch shall be located in rack BB.LER.01.
- G. DMX Two Port Node (Quantity:8)
 1. ETC Response Mk2 RSN-DMX2-0-P or approved equivalent.
 2. Provide node mounted in back box with clamp for portable hanging.
 3. Provide node with 15' Network patch cable.
 4. Portable node shall be powered via Ethernet.
 5. Color to be black.
- H. Theatrical Lighting DMX/NET Relay Rack, 24 space (Quantity: 1)
 1. ETC ECHO Pass through
 2. Provide with twenty-four (24) 20A single pole relays.
- I. Lighting Pipe Mount Box (Quantity: 30)
 1. ETC 9800 Series with offset brackets or approved equivalent
 2. Pipe boxes of the following configurations:
 - a. BB.LPB.01, 03, 04, 06, 08, 11, 13, 15, 16, 18, 20, 23, 25, 27, 28 and 30:
 - 1) 1 - 120V util ckts to 1 – L5-20 flush receptacle and 1 – Ethercon network control receptacle.
 - b. BB.LPB.02, 05, 07, 09, 10, 12, 14, 17, 19, 21, 22, 24, 26 and 29:
 - 1) 1 - 120V util ckt to 1 – L5-20 flush receptacle.
 3. Pipe mount boxes shall be mounted to 1 ½" Schedule 40 pipe in locations as shown on the drawings.
 4. Pipe mount boxes shall include labeling indicating what source(s) they are fed from located on the faceplate of the box. It is the responsibility of the theatrical lighting contractor to request this information.
 5. All low voltage control wiring shall be integral to the box and shall be isolated from the high voltage wiring by a low voltage barrier.
 6. All network connectors to be uniquely labeled using LTIE.XX. Label to contain the run length of the network cable and the maximum length of extension cable allowed between the network jack and any device connected to the jack.
 7. Relay panel circuits shall be labeled indicating what source(s) they are fed from located adjacent to the utility circuit receptacle. It is the responsibility of the theatrical lighting contractor to request this information.
 8. Relay panel circuits and numbering shall be located as noted on drawings
- J. Network/AC Plug In Panel (Quantity: 5)
 1. ETC or approved equivalent.
 - a. BB.LWP.01:
 - 1) 1 - 120V util ckt to 1 – 5-20 flush duplex receptacle and 1 – Ethercon network control receptacle.
 - b. BB.LWP.02 thru 05:
 - 1) 1 - 120V util ckt to 1 – L5-20 flush receptacle and 1 – Ethercon network control receptacle.
 2. Provide this as a flush wall plate mountable in a standard 2 Gang (Deep) backbox supplied by others.

3. Panel labelling TBD.
- K. Ellipsoidal Theatrical Lighting Instrument (Quantity: 20)
 1. ETC ColorSource Spot V w/shutter assembly or approved equivalent.
 - a. 19° - 0
 - b. 26° - 20
 - c. 36° - 10
 - d. 50° - 0
 2. Provide complete with c-clamp, gel frame, safety cable and 3' lead terminated to a L5-20 plug.
 3. Refer to Theatrical Lighting Plan for hang and focus details.
- L. Fresnel Theatrical Lighting Instrument (Quantity: 20)
 1. ETC ColorSource Fresnel V or approved equivalent.
 2. Provide complete with c-clamp, gel frame, safety cable and 3' lead terminated to a L5-20 plug.
 3. Refer to Theatrical Lighting Plan for hang and focus details.
- M. DMX Extension Cable (Quantity: 52)
 1. 5' – 0
 2. 10' – 0
 3. 15' – 40
 4. 25' – 12
 5. Cables shall be labeled for length using appropriately sized self-adhesive numbers 3" from both connector ends covered by clear heat shrink tubing.
 6. Cables shall be supplied with one (1) appropriately sized Velcro cable tie.
 7. Cables shall be black.
 8. Cable shall be constructed according to USITT DMX512/1990 standard.
 9. Cables shall be constructed with one (1) 5 pin XLR Male connector and one (1) 5 pin XLR Female connector.
- N. 20A PowerCon TRUE1 Extension Cable (Quantity: 52)
 1. 5' – 0
 2. 10' – 0
 3. 15' – 40
 4. 25' – 12
 5. Cables shall be labeled for length using appropriately sized self-adhesive numbers 3" from both connector ends covered by clear heat shrink tubing.
 6. Cables shall be supplied with one (1) appropriately sized Velcro cable tie.
 7. Cables shall be black.
 8. Cable shall be constructed using 12/3 SJOO-W cable.
 9. Cables shall be constructed with PowerCon TRUE1 connectors rated for 120vac @ 20amp loads.
- O. 3' Molded Cat6 Patch Cable (Quantity: 24)
- P. Gobo Holder (Quantity: 12)
 1. ETC 400PH-A or approved equivalent.
- Q. Steel Gobo, A size (Quantity: 24)
 1. Patterns TBD.
- R. Color Media:
 1. Provide a color media allowance for 4 – 20" x 24" sheets of R119.

2.7 RANCH HS BLACK BOX - ARCHITECTURAL LIGHTING CONTROL SYSTEM

- A. Vacancy Sensor (Quantity: 4)
 1. ETC EVAC-SR-4 small room vacancy sensor or approved equivalent
 2. Color to be black.
- B. Touch Screen / Controller (Quantity: 1)
 1. ETC ETS-4 EchoTouch MK2 controller or approved equivalent

- C. Architectural Entry Station (Quantity: 2)
 - 1. ETC E10002-4 2 button Inspire or approved equivalent
 - 2. Color to be black.
- D. Interface Station (Quantity: 1)
 - 1. ETC EACC-4 Echo Access Interface or approved equivalent
 - 2. Color to be black.
- E. Architectural Power Module (Quantity: 1)
 - 1. ETC E-SPM-A Unison Drd Echo Station Power Module with Auxilliary Station Power or approved equivalent
- F. Emergency Bypass Detection Kit (Quantity: 1)
 - 1. ETC Emergency Bypass Detection Kit EBDK
- G. Emergency Bypass DMX Controller (Quantity: 1)
 - 1. ETC DMX Emergency Bypass Controller DEBC-1

PART 3 - EXECUTION

3.1 GENERAL

- A. Coordinate work with other trades to avoid causing delays in construction schedule.
- B. Mount equipment and enclosures plumb and square. Permanently installed equipment shall be firmly and safely held in place.
- C. Cover edges of cable pass-through holes in chassis, racks, boxes, etc., with rubber grommets or Brady GRNY nylon grommeting.
- D. Mount equipment in racks and consoles and fully wire and test before delivery to job site. If field conditions prevent prior assembly of racks, notify Consultant in writing that racks will be fabricated on site and the reasons for the change.

3.2 CONTRACTOR/THEATRICAL LIGHTING CONTRACTOR INSTALLATION

- A. Confirm by site visit and by report from electrical contractor all field conditions, which may affect manufacture and installation of the Theatrical and Architectural Lighting Systems equipment prior to fabrication. Provide any additional hardware, panels and backboxes to accommodate field conditions. Submit all changes to equipment and mounting details to Consultant for review prior to fabrication.
- B. Supply specific, detailed direction to electrical contractor as required for proper installation of all Theatrical and Architectural Lighting System equipment, coordinated with actual site conditions.
- C. The Theatrical Lighting Contractor shall furnish all items required to properly install and secure Theatrical and Architectural Lighting System equipment in place.
- D. The electrical contractor shall place, install, and connect all Theatrical Lighting System equipment with the following exceptions:
 - 1. Theatrical and architectural control wire terminations.
 - 2. Theatrical fixtures set up, hang, and focus.
 - 3. Theatrical control console set up and programming.
 - 4. Architectural control station install, setup, and programming.
- E. If any panel, distribution box, or other device requires relocation or change of mounting detail, and this fact is not known until after shipment due to sequence of work, modify equipment or provide new equipment to fit revised location or mounting detail. Notify Consultant of any such changes and submit all changes to Consultant for review prior to fabrication.
- F. The Theatrical Lighting Contractor shall terminate all control wire in dimmer banks and all control panels.
- G. All control cables within the system shall be labeled with a unique identifying number at each end of the cable. Use only pre-printed labels. Cover labels with clear heat shrink tubing. Self-adhesive labels will not be allowed without prior approval of Consultant.

- H. Provide a service loop for all control cables and harness in place where applicable. No splices shall be allowed inside of control panels or racks. Provide terminal strips secured to panel or rack frame for all connections.
- I. Supply GC with all paint and supplies to correct minor cosmetic damage to equipment. Ensure that all equipment is clean and in perfect condition at time of Completion Checkout.
- J. Repair or replace any equipment, which has suffered non-cosmetic damage prior to time of Completion Checkout. Claims arising from repair or replacement of such damage shall be considered only after final acceptance of system by Owner.
- K. The contractor shall clean all racks, panels, and boxes of dirt, dust and debris, re-assemble all equipment, and replace all panels, covers and screws prior to time of Completion Checkout.
- L. Contractor shall not use any control equipment intended for installation for purpose of checking out wiring or circuitry prior an on-site factory trained technician testing the system (as specified above). Equipment may be used for such testing only in specific areas where proper conditions exist.
- M. Any existing equipment that is not required for the renovation to be salvaged by contractor/electrical contractor/theatrical lighting contractor and coordinated with owner as to whether it should be turned over or disposed of properly.

3.3 THEATRICAL LIGHTING CONTRACTOR TESTS AND ADJUSTMENTS

- A. Lamp all fixtures with the specified lamps and where applicable bench focus fixtures to a flat, even field.
- B. Hang, focus and color all lighting fixtures according to the Theatrical Fixture Layout drawing.
- C. Set up lighting control console and all related peripheral devices to include soft patching the console according to supplied paperwork.
- D. Set up and programming of architectural lighting control system and all related peripheral devices.
- E. Prior to energizing Production Lighting control systems, perform complete system checkout to verify that all items are correctly installed and shall safely operate as specified herein.
- F. Perform all tests and adjustments specified below upon Completion of installation of Production Lighting System.

3.4 TEST EQUIPMENT

- A. The following equipment shall be available for field-testing. Submit for approval, as a portion of the tender, list of test equipment.
 - 1. Ethernet Network cable and termination Qualifier
 - 2. DMX512 Protocol Tester.
 - 3. True RMS Multimeter, and clamp on ammeter.
 - 4. Circuit tester with adapters for all power receptacles provided in this section.
 - 5. Appropriate loads to test 100% of Theatre Lighting Circuits.
 - 6. Theatrical Lighting Contractor shall provide all appropriate adapters, extension cables and connectors necessary to interconnect test equipment to Theatrical Lighting system, and to perform all tests described below.
 - 7. Theatrical Lighting Contractor shall provide sufficient field service personnel (minimum of 2) to perform all tests specified below. Coordinate with the Division 26 contractor and to assist in all tests specified below. The contractor shall provide ladders and other devices, including 4 walkie-talkies, to allow access to all devices to be tested and communication between parties.

3.5 TEST PROCEDURES

- A. Perform all following tests & provide a written test report to the consultant:

1. Test all low voltage DMX/Architectural/Network circuits for proper wiring/termination, cable length, cable faults, Power Over Ethernet (POE) quality, and inducted voltage. Qualify Network circuits for Full Duplex 100BASE-TX operation. All Network tests to be executed after all Building Systems have been energized and are operating. Provide a written report of all test results organized by box/location.
 2. Inspect all device labels to ensure that devices are correctly and clearly labeled as specified and shown in specifying consultant approved submittal drawings.
 3. Test all line voltage circuits for proper wiring, polarity, connection to proper dimmer, and inspect for correct labeling.
 4. Test all power receptacles provided in this section.
 5. Test all Control Console operations.
 6. Test all control panels for all functions.
 7. Test all functions of all remote devices and all control plug-in points. When remote devices are NIC, but accommodations for these devices are included, provide identical devices for testing purposes.
 8. Test Control Console video systems for clear screen and high resolution of characters.
 9. Test all extension cables, adapters, etc.
 10. Perform visual testing of LED fixture dimming curves and consistency of dimming across all fixtures.
- B. Repair or replace any equipment that fails to conform to specification, and schedule second set of tests and adjustments. Provide test equipment and personnel specified above.
- C. Repeat testing and repair or replacement as required ensuring that the entire Theatrical Lighting System conforms to specification.
- D. Upon completion of testing, furnish Owner and Consultant a complete report on all field-testing and adjustment, certifying that system conforms to specification and that installation is complete and ready for inspection.

3.6 ACCEPTANCE

- A. Schedule inspection by Owner and Consultant no earlier than their receipt of above specified report.
- B. Provide all test equipment and personnel specified in "Field Testing and Adjustment" above.
- C. Coordinate with GC to ensure that no other work shall be scheduled in audience chamber or stage areas, and that all temporary bracing and scaffolding has been removed to permit full operation of and access to all equipment.
- D. At request of Consultant, repeat any and all test specified in "Field Testing and Adjustment" above in presence of Owner and Consultant.
- E. Should Owner or Consultant judge that any equipment fails to conform to specification, repair or replace that equipment within 30 days, and schedule second inspection. Should the Owner or Consultant judge that any work inspected is not substantially complete at time of Completion Checkout, schedule second inspection. Provide all equipment and personnel specified above.
- F. Schedule additional checkouts as required until Owner and Consultant judge entire Theatrical Lighting System to conform to specification.

3.7 INSTRUCTION OF OWNER PERSONNEL

- A. Provide four hours instruction to Owner designated personnel on the use and operation of the System, scheduled as one session, by an instructor fully knowledgeable and qualified in system operation. This instruction should include familiarization with all system components and basic operation of the lighting control console and architectural control system. The owner may record the instruction session at their cost. The System Reference Manuals shall be complete and on site at the time of this instruction.
- B. The lead technician for the project installation shall be present at the first two formal uses of the system.

END OF SECTION

**SECTION 11 6133
RIGGING SYSTEMS AND CONTROLS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Construction Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.
- B. Theatrical rigging system drawings (TE series).

1.2 SCOPE

- A. Intent: This specification covers the fabrication, furnishing, delivery, and installation of the Theatrical rigging system. The form of contract, general conditions, and the project drawings are considered to be parts of these specifications.
- B. Complete System: The Rigging Contractor shall provide all items necessary for a complete, safe, fully functional system as described herein, including all tools, scaffolding, labor, and supervision, even though they may not be specifically enumerated. Any errors, omissions or ambiguities do not relieve the Contractor of this responsibility but shall be brought to the attention of the Architect for clarification.
- C. Work Included: The work of this section shall include, but not necessarily be limited to the following:
 - 1. Cable Management
 - 2. Theatrical Curtains, Tracks and Accessories
 - 3. Theatrical Lighting Pipe Grid
- D. Related Work: Related work which is not included in this section:
 - 1. Gridiron, head and loft block beams, and all other structural steel and miscellaneous metals not specifically called out as part of this section.
 - 2. Galleries, ladders and catwalks.
 - 3. Stage flooring.
 - 4. Theatrical lighting.
 - 5. Electrical connections, conduit, boxes and wiring of any type.

1.3 GENERAL REQUIREMENTS

- A. Field Conditions: All bidders shall fully inform themselves of the conditions under which the work is to be performed. No additional compensation shall be allowed for any labor or item the bidder could have been fully informed of prior to the bid date.
- B. Safety: The systems shall conform to all applicable code requirements and shall be in conformance with industry standards of operation and practices. All materials, arrangements, and procedures shall comply with applicable code requirements, allowing the users to arrange and operate a safe assembly and working environment for audience and user personnel.
- C. Insurance: In the absence of more stringent requirements, the Rigging Contractor shall maintain injury and property liability insurance coverage throughout the project's scheduled timetable, including workmen's compensation coverage for Contractor's employees.

1.4 RESPONSIBILITY AND RELATED WORK

- A. The Theatrical Rigging Contractor shall be responsible for the following:
 - 1. Coordinate with the project Structural Engineer and verify the load capacities of the building structure where it interfaces with the rigging system.
 - 2. Provide all miscellaneous steel required for support of the Theatrical rigging system.

3. Perform regular site visits (minimum of one monthly) after steel erection is completed to provide coordination with all other trades that may conflict with the installation and operation of the rigging system.
 4. Provide regular reports of all site visits to the Architect, Client, and Consultant that document all coordination issues and their resolutions in regards to the rigging system.
 5. Provide and install all rigging system components.
 6. Terminate all control distribution cable, which shall be done in accordance with the manufacturer's specification.
 7. Furnish to the Electrical Contractor for installation all line level components and their housings.
 8. Provide a factory trained technician for system commissioning, including inspection, testing, and programming for the complete project.
 9. Provide shop drawings, As-built drawings, owner training, and operation manuals.
 10. Provide accessories and minor equipment items needed for a complete system, even if not specifically mentioned herein or in the drawings, without claim for additional payment.
 11. Assume responsibility for all engineering of systems described herein, including modification of and addition to any details as required in order to fulfill the design intent of the theatrical rigging system contract documents.
 12. Furnish sufficient workmen to operate all equipment and to assist in all tests specified. Provide ladders and other access devices, including 4 walkie-talkies, to allow access to all devices to be tested and communication between parties.
 13. Contractor shall obtain all licenses and permits necessary for the execution of any work pertaining to the installation within this scope of work.
- B. The Electrical contractor shall be responsible for the following:
1. Provide, install, and terminate all high voltage feeder circuits for the theatrical rigging system.
 2. Provide and install all low voltage control cabling.
 3. Provide and install all conduit, junction boxes, electrical wireways, and cable trays required for the rigging power and control systems.
 4. Pull all high voltage and low voltage cable in conduit.
 5. Provide sufficient workmen to assist Theatrical Rigging Contractor with system troubleshooting at first system energization.
 6. Clean all racks, panels, and boxes of dirt, dust and debris, re-assemble all equipment, and replace all panels, covers and screws prior to time of Completion Checkout.

1.5 REFERENCES

- A. International Building Code
- B. Underwriters Laboratories (U.L.)
- C. Occupational Safety and Health Administration (O.S.H.A.)
- D. National Fire Protection Association (N.F.P.A.).
- E. National Electrical Code (N.E.C.).
- F. American National Safety Institute (A.N.S.I.).
- G. Electronics Industries Association (E.I.A).
- H. TX State and City of Houston Building Code.
- I. National Electrical Manufacturers Association. (N.E.M.A.)
- J. Entertainment Services and Technology Technical Standards (E.S.T.A.)

1.6 SUBMITTALS

- A. Product Data: Submit manufacturer's product data sheets for each item of equipment in accordance with Division 1 of the project manuals. Data submittals shall be highlighted, alphabetized and tabbed. The Theatrical Rigging Contractor shall also provide a table of contents and quantities for all equipment.
- B. Shop Drawings: Indicate complete details and dimensions of work to be performed and indicate types and locations of equipment, fabricated equipment, and other details to completely describe work to be performed. Provide one PDF electronic file of submittal drawings for review. Keep a complete set of approved shop drawings on the job at all times. Non-approved shop drawings will not be allowed on the job site. Note any changes made during installation on a single set of drawings. This set of marked up drawings will not leave the jobsite until after the final system commissioning. Submit one PDF corrected electronic file set of drawings showing work as installed. All "as-built" drawings to be provided in PDF electronic form (ACAD 2000 or later). Details for both Shop/Submittal and As-Built drawings to include the following:
 - 1. System control riser diagram
 - 2. Control wiring charts
 - 3. Wire numbers on all schematics/riser diagrams
 - 4. Rigging Equipment physical and electrical details
 - 5. Control systems physical and electrical details
 - 6. Other details or schematics required for systems operation
 - 7. All Rigging Submittals to be stamped by a licensed engineer licensed in the state of TX.
 - 8. Note: Consultant will supply AutoCAD files of system design, if requested.
- C. Contract Closeout Submittals:
 - 1. Prepare and submit 3 copies of the System Reference Manual prior to Owner training in 3 ring binders, sized to hold the material plus 50% excess, with clear vinyl pockets on cover and spine for project title. Provide tabular dividers with permanent legends for the following sections:
 - 2. System Operation and Instructions- Prepare a complete and typical procedure for the operation of the equipment as a system, organized by subsystem or activity. This procedure should describe the operation of all system capabilities. Assume the intended reader of the manual to be technically inexperienced and unfamiliar with this facility.
 - 3. A list of all test results performed on the system as outlined in Section 3.
 - 4. A list of all equipment, indicating manufacturer, model, serial number, and equipment location (i.e. panel/rack/room number). Update following acceptance testing, if changed.
 - 5. A list of all settings of all semi-fixed controls. Update this document after the final acceptance testing.
 - 6. Photographically reproduced schematic wiring diagrams of the rigging system, based on the as-built documentation, at a reduced scale easy to handle but fully legible. Blue-line (or similar diazo process) prints are not acceptable.
 - 7. Manufacturer's Instruction Manuals for all items of equipment, incorporating or followed by manufacturer's warranty statements. For custom circuits or modifications, a description of the purpose, capabilities, and operation of each item.
 - 8. Manufacturer's Service Manuals and parts list for all equipment. Photocopies are not acceptable. For custom circuits or modifications, complete schematics and parts lists.
 - 9. Maintenance Instructions, including Contractor's maintenance phone number(s) and hours; maintenance schedule, description of products recommended or provided for maintenance purposes, and instructions for the proper use of these products.
 - 10. A legend of acronyms and abbreviations must accompany all documentation.
 - 11. Replacement parts lists of major items of equipment.
 - 12. Provide written report for dates of replacement of all batteries. This is to include UPS, and control systems.

13. Project record drawings “as-builts” to be provided within 4 weeks after system acceptance. Provide in PDF electronic form (ACAD 2000 or later, DWG or DXF files). See paragraph 1.6, item B above for further details.

1.7 QUALITY ASSURANCE

- A. Contractor's Qualifications: Have previously installed at least 4 jobs of similar magnitude, completed within the last five years. Provide name and phone number of reference for each representative project. Identify at least one such completed job available for inspection by Consultant or Owner's Representative.
- B. Bidder will confirm in writing that Sub-contractor firm has five years' experience with equipment and systems of the types specified, that the Sub-contracting firm maintains a fully staffed and equipped service facility, and that the firm is a franchised dealer and authorized service facility for the major brands specified, and that the firm is properly licensed to work in Houston, TX. Bidding contractor will identify all Sub-contractors on the Bid Response team and a detailed scope of work for each Sub-contractor.
- C. Provide a summary of experience of the project manager, lead engineer and lead installers assigned to this project. This will include key team members of any Sub Contractor. The on-site lead installer shall be an ETCP Certified Rigger.
- D. DELIVERY, HANDLING, STORAGE
- E. Comply with Division 1 General Conditions - Materials and Equipment section.

1.8 WARRANTY

- A. The Rigging Contractor shall provide a three year written guarantee against defects in materials or workmanship starting from the date of acceptance of equipment by the Owner's representative. The guarantee shall not cover damage due to normal wear and tear, acts of God, neglect, or improper use of equipment. Any required maintenance or replacement shall be provided by the Rigging Contractor within thirty days of notification by the Owner except for safety related items, which shall be corrected within 48 hours of notification. Subsequent to the expiration of the guarantee period the Rigging Contractor agrees to furnish repair and maintenance service, at the Owner's expense, within thirty days of request for such service. This warranty shall not void specific warranties issued by manufacturers for greater periods of time. Nor shall it void any rights guaranteed to the Owner by law.
- B. Theatrical Rigging Contractor to provide Owner with exact beginning and ending dates of the warranty period. Include the name of the person to call for service and telephone number. This information to be part of Project Record Drawings.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Standards:
 1. Materials shall conform to the following ASTM and ANSI standard specifications:
 - a. ASTM A-36 Specification for structural steel
 - b. ASTM A 47 Specification for malleable iron casting
 - c. ASTM A 48 Specification for gray iron casting
 - d. ASTM A 120 Specification for black and hot dipped zinc coated (galvanized) steel pipe for ordinary use
 - e. ANSI B18.2.1 & 2 Specification for square and hex bolts and nuts
 - f. ANSI E1.4-2009 Entertainment Technology – Manual Counterweight Rigging Systems.
 - g. ANSI E1.22 - 2009 Entertainment Technology - Fire Safety Curtain Systems
 2. In order to establish minimum standards of safety, the following factors shall be used:

- a. Cables and fittings 8:1 Safety Factor
 - b. Cable bending ratio Sheave tread diameter is 26 times cable diameter
 - c. Maximum fleet angle 1 1/2 degrees
 - d. Steel 1/5 of yield
 - e. Bearings Two times required load at full speed for 2000 hours
 - f. Bolts Minimum SAE J429 Grade 5 (ISO R898 Class 8.8), zinc plated
 - g. Motors 1.0 Service Factor
 - h. Gearboxes - 1.25 Mechanical Strength Service Factor
- B. Materials: All materials used in this project shall be new, unused and of the latest design. Re furnished and obsolete materials are not permitted.
- C. Sheaves:
- 1. Sheaves shall be one of the following materials:
 - a. ASTM A-48 Class 30 grey iron castings
 - b. Nylatron or Polyamide Nylon (PA6-G)
 - c. Steel
 - 2. Groove depths shall be sufficient to encompass fully the cables and ropes. Grooves shall have sloped sides (8 degree minimum) and conform to rope and cable manufacturers' standards for groove shape and tolerance.
 - 3. Sheaves shall be supported by bearings and a machined steel shaft, which shall be keyed to one side plate to prevent rotation. Proper adjustment of the bearing shall be accomplished by means of a fine thread, self-locking nut on the opposite end of the shaft. Each sheave shall run plumb and true without rubbing its side plates when rotated.
- D. Fabrication:
- 1. All manufactured equipment that is dependent on field conditions shall have those conditions field verified prior to fabrication and installation of all equipment. Notify Consultant of any discrepancies in site conditions or design documents as soon as identified.
 - 2. The mechanical fabrication and workmanship shall incorporate best practices for good fit and finish. There shall be no burrs or sharp edges to cause a hazard nor shall there be any sharp corners accessible to personnel.
 - 3. All moving parts shall have specified tolerances. Sheaves shall run plumb and true and shall not scrape housings.
 - 4. All equipment shall be built and installed to facilitate future maintenance and replacement.
- E. Finishes:
- 1. Paint shall be the manufacturer's standard finish and color except as noted.
 - 2. All turnbuckles, clips, tracks, chains and other items of incidental hardware shall be furnished plated or painted.
- F. Recommended Working Load: This specification calls for minimum recommended working loads for many hardware items. This is the maximum load which the manufacturer recommends be applied to properly installed, maintained, and operated new equipment. Manufacturer's recommended working loads shall be determined by calculations by a Licensed Professional Engineer and destructive testing by an independent testing laboratory. These calculations and reports shall be available for review.
- G. Materials and products required for work of this section shall not contain asbestos, polychlorinated biphenyls (PCB) or other hazardous materials identified by the Owner.

2.2 ACCEPTABLE MANUFACTURERS

- A. The following manufacturers of Theatrical Rigging equipment shall be considered pre-Qualified to supply Theatrical Rigging equipment.
- 1. H & H Specialties, Inc

2. Wenger / J.R. Clancy, Inc.
 3. SSRC
 4. Thern
- B. Additional qualified manufacturers will be considered subject to review by the Owner and Consultant. The Contractor will supply complete technical data specifications at the time of proposed substitution. The Contractor will arrange for product demo at the request of the owner and will pay ground freight shipping to and from site, or to and from Consultant's office. The Owner reserves the right to accept or refuse any substitution without condition.
- C. Substitutions: Comply with Division 1 General Conditions – Substitutions section. Any proposed substitutions must meet all specifications of the specified equipment. No product substitution will be accepted without the written approval of the Consultant and Owner.
- D. The manufacturer must have a product testing program, including determination of recommended working loads for products based on destructive testing by an independent laboratory and review by an independent licensed engineer. Approval to bid does not release the manufacturer from meeting this requirement.
- E. Requirements for Approval to bid: Equipment manufacturers seeking approval must submit the following information at least 2 weeks prior to the bid opening date. Failure to submit any of the required information will automatically disqualify the manufacturers from consideration of approval.
1. Evidence that the manufacturer has been in business for a minimum of eight years manufacturing Theatrical equipment.
 2. A listing of 8 equivalent installations including:
 - a. Name, address, and telephone number of Owner.
 - b. Name, address, and telephone number of Architect.
 - c. Scope of work.
 3. A brief written description of the manufacturer's operation including facilities, financial capabilities, and experience of key personnel.
 4. A statement from an insurance company indicating that the manufacturer carries primary product and general liability insurance of \$2,000,000 each, with excess liability coverage of \$10,000,000.
 5. A description of their details of their product testing program and methods along with the names and telephone number of the independent test lab and licensed professional engineer performing the product testing and review.
- F. Equipment and materials shall be new, and conform to applicable UL, CSA, or ANSI provisions. Take care during installation to prevent scratches, dents, chips, etc.
- G. The Theatrical Rigging Contractor shall verify all site conditions prior to fabrication and installation of all equipment. Notify Consultant of any discrepancies in site conditions or design documents as soon as identified.
- H. Use only components and items in the theatrical rigging systems that conform to industry practice and acceptable code standards.
- I. Wiring of power distribution cable shall be in accordance with the electrical engineer's specification.
- J. Wiring of control distribution cable shall be in accordance with the manufacturer's specification.
- K. Installation of theatrical rigging support steel shall be in accordance with the structural engineer's specification.

2.3 RANCH HS BLACK BOX

- A. Theatrical Lighting Pipe Grid (Quantity: 1)

1. Provide a Lighting grid and associated mounting hardware for the theatrical lighting instruments to be mounted in the Stage Pipe grid position. The grid shall be ~45' x 46'-3" long. The grid shall be built with a 4' x 4' pipe spacing. See drawing TE4.07 for detail.
 2. All pipes shall be 1 ½" Schedule 40 black seamless steel/iron pipe, treated to prevent corrosion. Pipe shall have a nominal OD of 1.9".
 3. All pipe crossovers shall be secured using pipe cross clamps.
 4. Co-ordinate all miscellaneous support steel requirements with the General Contractor.
 5. Co-ordinate installation of pipes and mounting hardware with Division 26 Contractor.
 6. Co-ordinate color of pipes and mounting hardware with the Specifying Lighting Consultant and Client.
 7. Co-ordinate location of support pipes and mounting with the Specifying Lighting Consultant and Client.
 8. All dimensions and conditions must be field verified before installation.
 9. Retain the services of a registered professional structural engineer, licensed to practice in Houston, TX to oversee and certify the design, development, fabrication and installation of the support pipes and associated rigging/mounting hardware. This does not include any required miscellaneous steel or structural supports that the support pipes are rigged/mounted to which are the responsibility of the projects structural engineer, architect and contractors other than the theatrical rigging vendor.
- B. Theatrical Curtains and Accessories
1. Walk Along Operated Traveling Curtain Track (Quantity: 4)
 - a. Provide curtain track complete with all necessary accessories for walk along operation located in the plan North, South, East and West wall positions. **Tracks to be ~40'3", ~40'-3", ~36'0" and ~36'0" long respectively.** Refer to TE series drawings.
 - b. Suspend track with two-piece clamp hanger. Install end stop at each track end. Where lengths exceed 24', connect tracks with minimum 12" long, two-piece splicing clamp.
 - c. Provide single carriers, spaced on 12" centers, constructed of two polyethylene wheels **fastened parallel to shielded ball bearing carrier body and supplied with heavy-duty** hook, swivel eye and trim chain for attachment of curtain. Black nylon shall be molded around shielded and greased ball bearing to form carrier body. Install round neoprene bumper between each carrier to reduce noise.
 - d. Track shall be finished with a semi-gloss black powder coat. All other steel components shall be black oxide finished.
 - e. Curtains per drapery schedule in paragraph 2.3, B, 2, b.
 2. Stage Drapery and Drops
 - a. Stage Curtain Construction
 - 1) Verify Drapery Measurements in Field before construction.
 - 2) All draperies must be either inherently flame retardant (IFR) or vat dyed and flame retarded (FR) by an immersion process.
 - 3) All fabric cuts must be full length with no splices. Any fabric sections with visible streaking or spotting must be cut from bolt and discarded.
 - 4) All Stage curtains furnished with sewn fullness must be box-pleated on 12-inch centers.
 - 5) All top hems must have a heavy-duty jute webbing double stitched at the top with machine set brass grommets one foot on center with tie lines or snap hooks as required.
 - 6) All draperies must have, as a minimum, 50% fullness unless otherwise specified.
 - 7) All hems must be double turned with no visible selvage edges.
 - 8) On-stage and off-stage vertical hems of Main Curtain and Traveler Curtains must have 1/2 bolt width turned back hems. All other vertical hems must be 3 inches.
 - 9) Floor length draperies must have a 6-inch bottom hem with a suspended inner canvas or muslin pocket containing #8 zinc plated chain weights.
 - 10) Bottom hems of border curtains must be 4 inches.

- 11) All fabrics with pile ends must be sewn with pile running down unless otherwise specified.
 - 12) Lining fabric (if required) shall be attached to the face fabric of the drape using short nylon webbing strips tacked along the bottom and sides of the curtain.
 - 13) All fabrics must be either inherently flame retardant or flame proofed using an immersion process. This process must be in accordance with the requirements of the NFPA 701 Large and Small scale test.
- b. Drapery Schedule
- 1) 12 each - Masking Leg Curtain from 21 oz IFR Polyester Velour in one section ~14'6" high X 10'0" wide. Provide curtain with snap hooks at top. Color to be black.
 - 2) 2 each - Masking Leg Curtain from 21 oz IFR Polyester Velour, in one section ~14'6" high X 8'0" wide. Provide curtain with snap hooks at top. Color to be black.
 - 3) 2 each - Masking Leg Curtain from 21 oz IFR Polyester Velour, in one section ~14'6" high X 6'0" wide. Provide curtain with snap hooks at top. Color to be black.

PART 3 - EXECUTION

3.1 GENERAL

- A. Coordinate work with other trades to avoid causing delays in construction schedule.
- B. Mount equipment and enclosures plumb and square. Permanently installed equipment shall be firmly and safely held in place.

3.2 CONTRACTOR/THEATRICAL RIGGING CONTRACTOR INSTALLATION

- A. Confirm by site visit and by report from general and electrical contractor all field conditions, which may affect manufacture and installation of the Theatrical Rigging Systems equipment prior to fabrication. Provide any additional hardware to accommodate field conditions. Submit all changes to equipment and mounting details to Consultant for review prior to fabrication.
- B. The Theatrical Rigging Contractor shall furnish all items required to properly install and secure Rigging System equipment in place.
- C. Repair or replace any equipment, which has suffered non-cosmetic damage prior to time of Completion Checkout. Claims arising from repair or replacement of such damage shall be considered only after final acceptance of system by Owner.
- D. The Theatrical Rigging Contractor in coordination with the Project General Contractor shall clean all pipe grid components of dirt, dust and debris prior to time of Completion Checkout.

3.3 THEATRICAL RIGGING CONTRACTOR TESTS AND ADJUSTMENTS

- A. Verify that all termination hardware is installed to specification.

3.4 TEST EQUIPMENT

- A. The following equipment shall be available for field-testing. Submit for approval, as a portion of the tender, list of test equipment.
 1. Torque Wrench
 2. Compression sleeve test gage.

3.5 TEST PROCEDURES

- A. Perform all following tests & provide a test report to the consultant:
 1. Measure Torque of all bolted connections to verify if they meet manufacturer's specification.
 2. Measure all Compression sleeve connections to verify if they meet manufacturer's specification.

3. Repair or replace any equipment that fails to conform to specification, and schedule second set of tests and adjustments. Repeat testing and repair or replacement as required to make the entire Theatrical Rigging System conform to specification.
4. Upon completion of testing, furnish Owner, Architect and Consultant a complete report on all field-testing and adjustment, certifying that system conforms to specification and that installation is complete and ready for inspection.

3.6 ACCEPTANCE

- A. Schedule inspection by Owner, Architect and Consultant no earlier than upon receipt of above specified report.
- B. Provide all test equipment and personnel specified in "Field Testing and Adjustment" above.
- C. Coordinate with GC to ensure that no other work shall be scheduled in audience chamber or stage areas, and that all temporary bracing and scaffolding has been removed to permit full access to all equipment.
- D. At request of Consultant, repeat any and all tests specified in "Field Testing and Adjustment" above in presence of Owner, Architect and Consultant.
- E. Should Owner, Architect or Consultant judge that any equipment fails to conform to specification, repair or replace that equipment within 30 days, and schedule second inspection. Should the Owner; Architect or Consultant judge that any work inspected is not substantially complete at time of Completion Checkout, schedule second inspection. Provide all equipment and personnel specified above.
- F. Schedule additional checkouts as required until Owner, Architect and Consultant judge entire Rigging System to conform to specification. After Completion Checkout, compensate Owner for any consulting and transportation costs incurred during subsequent checkouts. Final payment shall be withheld until systems have been thoroughly tested and adjusted and found to be in first class operating condition in every particular.

END OF SECTION

**SECTION 11 6843
SCOREBOARDS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single-sided LED scoreboards, timers and clocks.

1.02 REFERENCES

- A. Standard for Electric Signs, UL-48, 14th Edition.
- B. Standard for Control Centers for Changing Message Type Signs, UL-1433, 4th Edition.
- C. Standard for CAN/CSA C22.2 No. 207-M89.
- D. Federal Communications Commission Regulation Part 15.
- E. National Electric Code.

1.03 SUBMITTALS

- A. Product data: Submit manufacturer's product illustrations, data and literature that fully describe the scoreboards and accessories proposed for installation.
- B. Shop drawings: Submit mechanical, electrical drawings, and Structural Drawings sealed by an Engineer familiar with scoreboard design and licensed in the state of Texas.
- C. Shop drawing sheets that include engineering information designed by the Contractor's Delegated Design Engineer shall be signed and sealed in accordance with the Texas Engineering Practice Act. Sheets that do not provide information designed by the Contractor's Engineer do not require being signed and sealed. Calculation packages require a signed and sealed cover sheet only. Any submittals requiring to be signed and sealed that are received without the signature and seal will be rejected without review.
- D. Maintenance data: Submit manufacturer's installation, operation, and maintenance manuals.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Product delivered on site.
- B. Scoreboard and equipment to be housed in a clean, dry environment.

1.05 PROJECT CONDITIONS

- A. Environmental limitations: Do not install scoreboard equipment until mounting structure is secure and concrete has ample time to cure.
- B. Field measurements: Verify position and elevation of structure and its layout for scoreboard equipment. Verify dimensions by field measurements.
- C. Verify mounting structure is capable of supporting the scoreboard's weight and wind load in addition to the auxiliary equipment.
- D. Installation may proceed within acceptable weather conditions.

1.06 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of scoring or related equipment through one source from a single manufacturer.
- B. ETL listed to UL Standards 48 and 1433.
- C. NEC compliant.
- D. FCC compliant.
- E. ETLC listed to CAN/CSA 22.2.

1.07 WARRANTY

- A. Scoreboards shall be guaranteed for a period of five (5) years. LED components are guaranteed for a period of ten (10) years.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. The Spectrum Corporation: www.spectrumscoreboards.com.
- B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DESIGN REQUIREMENTS

- A. Provide labor, material, equipment and supervision necessary to complete installation of pre-engineered Scoreboard including, but not limited to the following: concrete foundation/piers (for freestanding scoreboards), steel substructure, and Scoreboard support structure. This scope is a performance-based specification. The scope includes all design and installation as required for a complete installation. A full copy of the geotechnical report copy has been included in the project manual. Design shall comply with all applicable codes and accessibility regulations.
- B. Design: Conform to AISC Steel Construction Manual and AA Aluminum Design Manual.
- C. Applicable Codes: Design and workmanship shall be in accordance with the applicable building code.
- D. Design Loads:
 - 1. Wind Loads: Applicable building code.
 - 2. Snow Loads: Applicable building code.
 - 3. Seismic Loads: Applicable building code.
 - 4. Handrail and Guardrail: 250 lbs. concentrated in any direction.
- E. Shop Connections: Welded and capable of carrying stress put upon them.
- F. Welding: AWS D1.1.
- G. Concrete Foundations: Manufacturer shall design concrete foundation based on applicable loads and geotechnical values provided in the Geotechnical Report. Concrete foundations shall be installed as specified in Section 03 3000.

2.03 FOOTBALL SCORE BOARDS - HIGH SCHOOL

- A. Basis of Design: Spectrum Model 11020-P4 Football Scoreboard. No wireless.
- B. Features:
 - 1. 99 minute up/down counting clock
 - 2. Home and Visitor scores to 99 with instant posting and reset to 0.
 - 3. Quarter and Down shall increment by one or display the numerals 3 to 4.
 - 4. Yards to Go shall display yards remaining (0 to 99) with instant reset to 10.
 - 5. Fractional seconds feature shows to 1/100 of a second, the time left in the period.
 - 6. Automatic Quarter Reset sets up next quarter and advances period automatically.
- C. Components: All electron components shall be solid state. Component module shall be accessible from the back of the scoreboard.
- D. Controls: Controls shall be 100% solid state. The microprocessor (MPU) computer chip shall be located inside the control console. Low voltage control signals shall be sent from the control console over a 3 wire control cable to the scoreboard. An interpreter module shall decode the signals and display the appropriate digits on the scoreboard.
- E. Console: The operator's control console shall not require hazardous 120 VAC electrical power. The low voltage control console shall be housed in a protective, weather resistant carrying case. A single 10' long, 3 wire, low voltage control cable shall unplug and store inside the carrying case.

- F. Multi-Sport: MSX Scoreboard Controller: The control panel switch functions shall be changed (depending on the type of scoreboard being used, i.e., basketball, volleyball) by removing a single switch label insert from under the overlay and reinserting the appropriate switch label insert. The insert shall slide in and out and is locked in place. (This allows a single control to operate multiple scoreboards of different sports.) Each sport has a single switch label insert.
- G. Electrical: Scoreboard shall require not more than 19.5 amperes at 120VAC, 60Hz. No electrical power outlet required for control console. Ground exterior all scoreboards: to be installed in a metal raceway and terminated on the ground lug in the back of the scoreboard at each end; number 6 conductor. Ground wire to be bonded per NEC.
- H. Provide Team Name, Mascot and Custom 2-Tone Color.

2.04 TIMING DISPLAY

- A. Basis of Design: Spectrum Model 1125T-UL4 single-sided timing display can be configured to count up or down from any preset number from 0 to 99.
- B. Display:
 - 1. Overall cabinet shall be 4 feet in height by 4 feet in length by 6 inches in depth including mounting brackets and constructed of .050 aluminum. Cabinet to be shipped assembled and constructed for mounting.
 - 2. Cabinet color shall be white unless otherwise specified in manufacturers standard colors.
 - 3. Approximate weight shall be 140 pounds for two displays.
 - 4. Display digits shall be made of 3 inch by 3 inch circuit card mounted pixels. Each pixel shall be individually replaceable and contain sixteen (16) LEDs each. LEDs shall be red or amber in color.
 - 5. Each pixel is conformal-coated front and back to protect the electronics from outside elements and are individually serviceable from the front of the scoreboard cabinet.
 - 6. All pixels are interchangeable throughout the scoreboard and are rated at least 100,000 hours of use.
 - 7. Digit height shall be 30 inches.
 - 8. Timers shall have a display capacity up to "99".
 - 9. Display configuration shall be 5 x 9.
 - 10. Digits shall consist of the following number of pixels: 30 inch, 27 pixels (16 LEDs per pixel).
 - 11. LED Digit Brightness: 40,000 MCD (millicandela).
 - 12. 2.1.13 Finish in Two-Component Polyurethane coating.
 - 13. Electronics to be packed in a high voltage plug-in processor accessible from the front of each cabinet.
 - 14. Power to be 270 watts maximum, 120 VAC, 60 Hz.
- C. Control:
 - 1. No primary control is furnished. A Snap Clock Handswitch shall be furnished which plugs into the MSX scoreboard control console for snap timer operation.

2.05 INTERIOR SCOREBOARDS

- A. Basis of Design: Spectrum Model Model 5250. No wireless.
- B. Features:
 - 1. Quarters, 1-4, shall be displayed using a numeral lampbank.
 - 2. Face-mounted horn shall sound manually when clock is off and can sound automatically at end of period.
 - 3. Automatic substitution feature shall allow the operator to program the horn to sound automatically the next time the clock is turned off, thus alerting officials of a substitution.

4. Time-out timer shall display time remaining in the time-out. A very short horn blast shall warn of there being 15 seconds remaining in the time-out. The control box speaker shall signal the end of the time-out.
 5. Automatic Quarter Reset sets up next quarter and advances period automatically.
- C. Console plug to be located at front face of bleachers and at opposite side of courts. Provide automatic retracting components to retract console cable when bleachers are closed.
 - D. Provide Team Name, Mascot and Custom 2-Tone Color.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that mounting structure is ready to receive scoreboard. Verify that placement of conduit and junction boxes are as specified and indicated in plans and shop drawings. Verify concrete has cured adequately according to specifications.

3.02 INSTALLATION

- A. All power and control cables to scoreboards and displays will be routed in conduit. Power to the scoreboards/displays as well as raceways shown on electrical plans by the Electrical Contractor. Scoreboard control wiring including conduit will be the responsibility of the contractor assigned the scoreboard equipment.
- B. Install scoreboards and exterior displays to beams in location detailed and in accordance with manufacturer's instructions. Verify unit is plumb and level.
- C. Provide scoreboard and required structure in its entirety

3.03 INSTALLATION-CONTROL CENTER

- A. Provide boxes, cover plates and jacks in locations per plans.
- B. Test connect control unit to all jacks and check for proper operation of control unit, scoreboard and all features. Leave control unit in carrying case and other loose accessories with Owner's designated representative.
- C. Verify earth ground does not exceed 15 ohms.

END OF SECTION

**SECTION 12 2100
WINDOW BLINDS**

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Horizontal Blinds

1.02 RELATED WORK

- A. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 01 of these specifications.

1.03 REFERENCE STANDARDS

- A. WCMA A100.1 - Safety of Window Covering Products; 2022

1.04 SCOPE

- A. Furnish and install window blinds in accordance with specifications, drawings, and contract documents.
- B. All workmanship, details and procedures shall comply with current manufacturer's recommendations.
- C. General locations and detail of system are shown on the drawings and/or window schedule.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product literature and installation instructions.
- C. Shop Drawings: Indicate field-measured dimensions of opening which are to receive blinds, details on mounting surface and sill conditions, and details of corners and conditions between adjacent blinds.
- D. Samples for selection of Colors: Submit manufacturers full range of colors.

1.06 WARRANTY

- A. Limited Lifetime Warranty: Manufacturer shall repair or replace for the life of the blind, at its option, without charge to the Owner, any part found defective in workmanship or material as long as the blind remains in the same window for which it was purchased.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

- A. Levolor Contract: www.levolor.com.
- B. Hunter Douglas: www.hunterdouglascontract.com.
- C. Spring Window Fashions, LLC: www.springwindowfashions.com
- D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 HORIZONTAL BLINDS

- A. Basis of Design: Levolor Contract; Riviera Contract 1" Blind, model #RIV1C.
- B. Materials:
 - 1. Head Channel shall be of .025" thick Tomized steel, U-shaped 1" high x 1-9/16" wide with flanged edges at top, and coated with a baked-on finish. All hardware shall be enclosed in the metal head.
 - 2. Guardian Tilter TM shall be of .042" Tomized steel or of .040" nylon with automatically disengaging worm and gear mechanism to eliminate overdrive and prevent strain or damage to blind.
 - 3. Tilt Wand shall be transparent with a hexagonal cross section 5/16" across flats.

4. Lift cords are not allowed in compliance with WCMA A100.1 - Safety of Window Covering Products; 2022.
5. Drum and Cradle shall be provided for each blind ladder.
 - a. Drum shall be of .031" Tomized steel having two holes with rolled edges to anchor barbs of both ladder ends.
 - b. Cradles shall be of .042" thick Tomized steel, having two holes with rolled edges to guide cords through bottom of head channel without abrasion.
6. Tilt Rod shall be U-shaped with a circular radius of approximately 1/8" designed to achieve minimum torsional deflection. For blinds over 60" wide and under 80" long or over 55" wide and over 80" long, tilt rod shall be a solid D-shaped rod with an average cross section of 1/4" designed to achieve minimum torsional deflection.
7. End Braces shall be of .037" thick Tomized steel with reinforcing ribs and field adjustable tabs.
8. Installation Brackets shall incorporate a rivet-hinged safety locking front cover and shall be at least .048" thick Tomized steel with baked-on finish to match head channel.
9. Intermediate Brackets shall be .050" Tomized steel and shall be installed with blinds over 60" wide and under 80" long or over 55" wide and over 80" long.
10. Ladders (slat supports) shall be of braided polyester yarn designed for maximum strength and flexibility combined with minimum stretch. Rungs shall consist of not less than two crossed cables inter-braided with the vertical components. Ladders shall support the slats without visible distortion. Distance between ladders are not to exceed 23" for blinds over 80" long. For blinds up to 80" long, distance between ladders shall not be greater than 22".
11. Slats shall be of virgin aluminum alloyed for maximum strength and corrosion resistance. Slats shall be nominally 1" wide with an elliptical crown formed after coating and curing. Slat thickness and ladder support distances shall prevent visible sag or bow after continued use indoors. Slats shall be un-perforated.
12. Bottom Rail shall be of .031" Tomized steel formed after coating and shall be provided with color-compatible molded plastic ladder and end caps.
13. Color of blind shall be as selected by Architect.
14. Blinds shall be continuous between jambs unless otherwise noted.

PART 3 – EXECUTION

3.01 INSPECTION AND PREPARATION

- A. Blind subcontractor shall be responsible for inspection of site, approval of mounting surfaces, installation conditions and field measurements for this work.

3.02 INSTALLATION

- A. Installation shall comply with manufacturer's recommendations.

3.03 CLEANING

- A. Clean finished installation of dirt and marks as recommended and approved by the manufacturer.
- B. Leave work area clean and free of debris.

END OF SECTION

**SECTION 12 3200
MANUFACTURED WOOD CASEWORK**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manufactured custom plastic-laminate-faced casework, with cabinet hardware.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Blocking and nailers for anchoring casework.
- B. Section 07 9200 - Joint Sealants: Sealing joints between casework and countertops and adjacent walls, floors, and ceilings.
- C. Section 12 3600 - Countertops: Additional requirements for countertops.

1.03 DEFINITIONS

- A. Exposed portions of include surfaces visible when doors and drawers are closed. Bottoms of cases more than 4'-0" above floor shall be considered as exposed. Visible members in open cases or behind full glass doors also shall be considered as exposed portions.
- B. Semi-exposed portions of casework includes those members behind opaque doors or framed glass doors, such as shelves, dividers, interior face of ends, case back, drawer sides, backs and bottoms, and back face of doors.
- C. Concealed portions of casework include sleepers, dust panels and other surfaces not usually visible after installation. Tops of cases 6'-6" or more above floor shall be considered concealed.

1.04 REFERENCE STANDARDS

- A. ANSI A135.4 - Basic Hardboard; 2012 (Reaffirmed 2020).
- B. ANSI A208.1 - American National Standard for Particleboard; 2022.
- C. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications; 2016.
- D. ASTM C1036 - Standard Specification for Flat Glass; 2021.
- E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- F. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- G. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting at least one week prior to the start of the work of this section; require attendance by all affected installers.
- B. Keying Conference: Conduct conference prior to ordering keys. Incorporate conference decisions into keying submittal.

1.06 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Component dimensions, configurations, construction details, joint details, attachments and hardware.
- C. Shop Drawings: Indicate casework types, sizes, and locations, using large scale plans, elevations, and cross sections. Include rough-in and anchors, reinforcements, and blocking, placement dimensions and tolerances, clearances required, and keying information.
- D. Samples for Finish Selection: Fully finished, for color selection. Minimum sample size: 6 inches by 6 inches or as indicated.
 - 1. Plastic laminate samples, for color, texture, and finish selection, size 6 inches by 6 inches.

- E. Samples for Hardware Selection: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.
- F. Manufacturer's Qualification Statement.
- G. Installer's Qualification Statement.
- H. Maintenance Data: Manufacturer's recommendations for care and cleaning.
- I. Finish touch-up kit for each type and color of materials provided.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience and one project within the last five years with a value of woodwork within 20 percent of cost of woodwork for this project.
- B. Perform cabinet construction in accordance with AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards.
- C. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than five years of documented experience and approved by manufacturer.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect items provided by this section, including finished surfaces and hardware items during handling and installation. For metal surfaces, use polyethylene film or other protective material standard with the manufacturer.
- B. Acceptance at Site:
 - 1. Do not deliver or install casework until the conditions specified under Part 3, Examination Article of this section have been met. Products delivered to sites that are not enclosed and/or improperly conditioned will not be accepted if warping or damage due to unsatisfactory conditions occurs.
- C. Storage:
 - 1. Store casework in the area of installation. If necessary, prior to installation, temporarily store in another area, meeting the environmental requirements specified under Part 3, "Site Verification of Conditions" Article of this section.

1.09 MOCK-UP

- A. Provide full size base cabinet, upper cabinet, and tall cabinet complete with drawers, door, adjustable shelf and countertop.
- B. See Section 01 4000 - Quality Requirements for additional requirements.
- C. Locate where directed by the Architect.
- D. Mock-up may remain as part of the Work.

1.10 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion, at no additional cost to Owner. Defects include, but are not limited to:
 - 1. Ruptured, cracked, or stained finish coating.
 - 2. Discoloration or lack of finish integrity.
 - 3. Cracking or peeling of finish.
 - 4. Delamination of components.
 - 5. Failure of adhesives.
 - 6. Failure of hardware.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer shall be members in good standing of the Architectural Woodwork Institute (AWI/AWMAC/WI).
- B. Obtain casework from single source and manufacturer, unless otherwise indicated.

2.02 CASEWORK, GENERAL

- A. Quality Standard: AWI/AWMAC/WI (AWS), unless noted otherwise.
- B. Types: When more than one type is required, see drawings for location of each type of casework.
- C. Plastic Laminate Faced Cabinets: Custom Grade.
- D. Desks and Display Cases - Premium Grade
- E. Refer to 01 6210- Schedule of Materials and Colors and Drawings for additional casework details.

2.03 LUMBER/PVC MATERIALS

- A. Hardwood Lumber: NHLA; Graded in accordance with AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, Grade II/Custom; average moisture content of 6-8 percent; species as scheduled.
- B. Solid Lumber: Any Species, with no defects affecting strength or utility.
- C. Provide Palight Outdoor; Rigid Foam PVC as manufactured by Palram for all cabinet bases.

2.04 PANEL MATERIALS

- A. Thermally Fused Laminate (TFL): NEMA LD 3, laminate panels.
- B. Plastic-laminate-faced Plywood for Non-Decorative Purposes: NIST PS 1, Interior rated adhesives, core of wood plies from any species suitable for intended use unless otherwise indicated, thickness as indicated or as required by application.
 - 1. Provide 1" thick shelves at storage/book rooms.
 - 2. Provide 1" thick shelves when length is 36" or longer.
- C. Particleboard: ANSI A208.1; medium density industrial type, minimum 45 lb./cu. ft. density, Grade 1-M-2 or better, as specified in AWI/AWMAC/WI (AWS), composed of wood chips bonded with manufacturer's recommended adhesive under heat and pressure; sanded faces; thickness as required; use for components indicated on drawings.
- D. Medium Density Fiberboard (MDF): ANSI A208.2 ; type as specified in AWI/AWMAC/WI (AWS); composed of wood fibers pressure bonded with manufacturer's recommended adhesive to suit application; sanded faces; thickness as required.
 - 1. Use for door and drawer fronts.
 - 2. For doors 6' high and greater use 1" thick material
- E. Hardboard: AHA A135.4; Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick, smooth one side for horizontal applications, smooth two sides (S2S) for vertical applications; use for drawer bottoms, dust panels, vertical slot dividers, and other components indicated on drawings.
- F. Solid Molded High Density Polyethylene (HDPE), tested in accordance with NFPA 286; smooth finish face sheet, reference drawings for thickness as required and locations. Color: Black.
- G. Plastic Edge Banding: 3mm PVC, flat shaped; smooth finish; of width to match component thickness.

2.05 SHOP TREATMENT OF WOOD MATERIALS

- A. Provide UL approved identification on fire retardant treated material.
-

- B. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.

2.06 FABRICATION

- A. Assembly: Shop assemble casework items for delivery to site in units easily handled and to permit passage through building openings.
- B. Construction: As required for selected grade.
- C. Cabinet support bases shall be fabricated from Lomatex Plastic Bases.
- D. Fabricate all drawers boxes using 1/2" inch, 9-ply laminated hardwood plywood. The top edges of the drawer box sides and back are radiused. Drawer bottom is let in on four sides, and securely glued underneath with a continuous bead of glue around the perimeter of the drawer bottom. Additional bottom braces are used on drawers over 24" wide. All components have one coat of clear waterproof sealer. Drawer boxes are screw-attached to separate drawer fronts.
- E. Glazing for Doors: Clear tempered glass.
- F. Fittings and Fixture Locations: Cut and drill components for fittings and fixtures.
- G. Hardware Application: Factory-machine casework members for hardware that is not surface applied.
- H. Access Panels: Where indicated, for maintenance of utility service and mechanical and electrical components.
- I. Removable back panels on indicated base cabinets. Provide partial height back panels at sink cabinets.
- J. Fixed panels at backs of open spaces between base cabinets.
 - 1. Provide cutouts for power and data receptacles where indicated on drawings.
- K. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- L. Scribes and Fillers: Panels of matching construction and finish, for locations where cabinets do not fit tight to adjacent construction.
- M. Apron Frames: Construction similar to other cabinets, with modifications.
 - 1. Frames fabricated from panels standard with the manufacturer. Include front and back panels, with drawer suspension framing mechanically fastened to support channels spanning between them.
 - 2. Apron Drawers: Manufacturer's standard drawer construction and size for apron installation. Single drawer for aprons up to 48 inches wide, two drawers for wider aprons.
- N. Countertop Panel-Type Supports: Materials similar to adjacent casework, 1-1/2 inch in width, with front-to-back and toe space dimensions matching base cabinet. Designed to be secured in a concealed fashion to countertop material. Include two leveling devices per support panel.

2.07 PLASTIC-LAMINATE-CLAD CASEWORK

- A. Plastic-Laminate-Clad Casework: Solid wood and wood panel construction; each unit self-contained and not dependent on adjacent units or building structure for rigidity; in sizes necessary to avoid field cutting except for scribes and filler panels. Include adjustable levelers for base and tall cabinets.
 - 1. Style: Flush overlay. Ease doors and drawer fronts slightly at edges.
 - 2. Cabinet Nominal Dimensions: Unless otherwise indicated, provide cabinets of widths and heights indicated on drawings, and with following front-to-back dimensions:
 - a. Base Cabinets: 24 inches.
 - b. Tall Cabinets: 24 inches.
 - c. Wall Cabinets: 14 inches.
 - 3. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline.

- a. See Section 01 6210 - Schedule of Materials and Colors for products Basis of Design and additional information.
- b. Finish: Matte or suede, gloss rating of 5 to 20.
- c. Surface Color and Pattern: As indicated on drawings.
- d. Exposed Interior Surfaces: Thermally fused laminate.
 - 1) Color: White.
- e. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
- f. Cap exposed plastic laminate finish edges with plastic trim.
 - 1) 3mm PVC, flat shaped; smooth finish; of width to match component thickness
 - (a) Door and drawer fronts (Color match to face laminate).
 - (b) Counter top and shelving exposed edges (Color match to face laminate).
 - 2) 1mm PVC, flat shaped; smooth finish; of width to match component thickness.
 - (a) Backsplash and return exposed edges (Color match to face laminate).

2.08 COUNTERTOPS

- A. Countertops: As specified in Section 12 3600.

2.09 CABINET HARDWARE

- A. Hardware: BHMA A156.9, types as indicated for quality grade specified.
- B. Drawer slides shall be heavy duty, self-closing with positive in-stop and out-stop. Dynamic load rating of 100 lb. life cycle test/150 lb. static load rating. File drawers and paper storage drawers to receive full extension, 100 lb. dynamic rating drawer slides.
- C. Drawer and door pulls shall be chrome wire pull type, and hinges shall be heavy duty type for overlay doors, Stanley No. HT1591, US26D finish.
- D. Locks shall be National five-pin tumbler grooved key type, nickel plated cylinder and cam with non-removeable core. Provide two (2) keys per lock, not per room and two (2) master keys per room where doors are scheduled to receive locks. Furnish catch Stanley No. 36 on door not receiving lock. All locks on cabinets in the same room are to be keyed alike.
 - 1. Cabinet locks shall be National Model No C8053 disc tumbler cam lock. Cylinder face and keys to be engraved with matching numbers. Cabinet Locks in each room are to be keyed alike. Locks are to be master keyed to E41A. Provide two (2) master keys per room.
 - 2. All clinic cabinet locksets shall allow for 90/180 degree locking and all removal of key in both locked and unlocked position. Clinic Locks - CCL cam lock Model No B15760-US26D keyed to AUE39. Stamp AUE39 on cam lock face. Provide two (2) keys per lock, not per room and two (2) master keys per room.
 - 3. All casework doors and drawers and display cases shall have locks except at sink base cabinets.
- E. Cabinet hinges shall be (RPC) 853 x US26D for typical 3/4" doors and (RPC) 844 x US26D for 1" thick doors.
- F. Coat Hooks:
 - 1. Ceiling Mounted: (IVES)#580
 - 2. Wall Mounted: (IVEVS)#582
- G. Clothes Rod each to have:
 - 1. Rod(K & V)#770 5
 - 2. Flange(K & V)#764 CHR
- H. Adjustable Shelves, each to have:
 - 1. 4 Standards (K & V)#255
 - 2. 2. 4 Brackets/Shelf(K & V)#256
- I. Adjustable Shelves at Display Cases, each to have:
 - 1. Standards (K & V)#87

2. Brackets/Shelf(K & V)#186
- J. Grommets (provide one at each knee space), each to be:
 1. Outwater#31-2" (Plastic) - Color Selected by Architect
 - a. Plastics Industries, Inc.
- K. Pull-Out Keyboard Tray:
 1. MicroComputer Accessories Model No. MCA-6110, molded plastic tray with wrist rests which lifts up to reveal a pencil storage compartment.
 2. Sliding drawers to extend 9-3/4 inches past edge of desk.
 3. 21-1/2 inches x 2 inches x 14-1/2 inches outside dimensions and 20 inches x 3 inches x 8-3/4 inches inside.
 4. Lock-in, lock-out feature.
 5. Factory attached slotted surface mounting brackets.
 6. Precision ball bearings and nylon retainers for quiet operation.
- L. All hardware shall be subject to approval by the Owner/Architect. All keying shall match existing master key system and be approved by the Owner.

2.10 MATERIALS

- A. Wood-Based Materials:
 1. Solid Wood: Air-dried to 4.5 percent moisture content, then tempered to 6 percent moisture content before use.
 2. Composite Wood Panels: Containing no urea-formaldehyde resin binders.
- B. Concealed Solid Wood or Plywood: Any species and without defects affecting strength or utility.
- C. Hardboard: ANSI A135.4, Class 1, tempered.
- D. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications, complying with Grade requirements, and standard with the manufacturer.
 1. Provide specific types as follows:
 - a. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, colors as scheduled, .
 - b. Vertical Surfaces: VGS, 0.028 inch nominal thickness, colors as scheduled, .
 - c. Post-Formed Horizontal Surfaces: HGP, 0.039 inch nominal thickness, colors as scheduled, .
 - d. Post-Formed Vertical Surfaces: VGP, 0.028 inch nominal thickness, colors as scheduled, .
 - e. Flame Retardant Surfaces: HGF, 0.048 inch nominal thickness, colors as scheduled, .
 - f. Cabinet Liner: CLS, 0.020 inch nominal thickness, colors as scheduled, .
 - g. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.
- E. Glass: Fully tempered float; ASTM C1036, Type 1, Quality Q3; ASTM C1048, tempered using horizontal tempering; 1/4 inch thick minimum; clear.

2.11 ACCESSORIES

- A. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- B. Concealed Joint Fasteners: Corrosion-resistant, standard with manufacturer.
- C. Grommets: Standard plastic or rubber grommets for cut-outs, in color to match adjacent surface.
- D. Sealant for Use in Casework Installation:
 1. Manufacturer's recommended type.

PART 3 EXECUTION

3.01 PREPARATION

- A. Large Components: Ensure that large components can be moved into final position without damage to other construction.

3.02 EXAMINATION

- A. Site Verification of Environmental Conditions:
 - 1. Do not deliver casework until the following conditions have been met:
 - a. Building has been enclosed (windows and doors sealed and weather-tight).
 - b. An operational HVAC system that maintains temperature and humidity at occupancy levels has been put in place.
 - c. Ceiling, overhead ductwork, piping, and lighting have been installed.
 - d. Installation areas do not require further "wet work" construction.
- B. For Base Cabinets Installation: Examine floor levelness and flatness of installation space. Do not proceed with installation if encountered floor conditions required more than 1/2 inch leveling adjustment. When installation conditions are acceptable, for each space, establish the high point of the floor. Set and make level and plumb first cabinet in relation to this high point.
- C. For Wall Cabinets Installation: Examine wall surfaces in installation space. Do not proceed with installation if the following conditions are encountered:
 - 1. Maximum variation from plane of masonry wall exceeds 1/4 inch in 10 ft and 1/2 inch in 20 ft or more, and/or maximum variation from plumb exceeds 1/4 inch per story.
 - 2. Maximum Variation of finished gypsum board surface from true flatness: 1/8 inch in 10 feet in any direction.
- D. Verify adequacy of support framing and anchors.
- E. Verify that service connections are correctly located and of proper characteristics.

3.03 INSTALLATION

- A. Perform installation in accordance with manufacturer's instructions.
- B. Use anchoring devices to suit conditions and substrate materials encountered. Use concealed fasteners to the greatest degree possible. Use exposed fasteners only where allowed by approved shop drawings, or where concealed fasteners are impracticable.
- C. Set casework items plumb and square, securely anchored to building structure.
- D. Align cabinets to adjoining components, install filler and/or scribe panels where necessary to close gaps.
- E. Fasten together cabinets in continuous runs, with joints flush, uniform and tight. Misalignment of adjacent units not to exceed 1/16 inch. In addition, do not exceed the following tolerances:
 - 1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet.
 - 2. Variation of Bottoms of Wall Cabinets from Level: 1/8 inch in 10 feet.
 - 3. Variation of Faces of Cabinets from a True Plane: 1/8 inch in 10 feet.
 - 4. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch.
 - 5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch.
- F. Secure wall and floor cabinets to concealed reinforcement and blocking at gypsum board assemblies.
- G. Base Cabinets: Fasten cabinets to service space framing and/or wall substrates, with fasteners spaced not more than 16 inches on center. Bolt adjacent cabinets together with joints flush, tight, and uniform.
 - 1. Where base cabinets are installed away from walls or service space framing, anchor to floor at toe space at not more than 24 inches on center, and at sides of cabinets with not less than two fasteners per side.

- H. Wall Cabinets: Fasten to hanging strips, and/or wall substrates. Fasten each cabinet through back, near top, at not less than 16 inches on center.
- I. Install hardware uniformly and precisely.
- J. Countertops: Install countertops intended and furnished for field installation in one true plane, with ends abutting at hairline joints, and no raised edges. Exposed corners to have 1-1/2' radius.
- K. Replace units that are damaged, including those that have damaged finishes.

3.04 ADJUSTING

- A. Adjust operating parts, including doors, drawers, hardware, and fixtures to function smoothly.

3.05 CLEANING

- A. Clean casework and other installed surfaces thoroughly.

3.06 PROTECTION

- A. Do not permit finished casework to be exposed to continued construction activity.
- B. Protect casework and countertops from ongoing construction activities. Prevent workmen from standing on, or storing tools and materials on casework or countertops.
- C. Repair damage, including to finishes, that occurs prior to Date of Substantial Completion, using methods prescribed by manufacturer; replace units that cannot be repaired to like-new condition.

END OF SECTION

**SECTION 12 3551
MUSIC INSTRUMENT STORAGE CASEWORK**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Acoustically Enhanced Music Instrument Storage Casework

1.02 RELATED REQUIREMENTS

- A. General and Supplementary Conditions of the Contract, Division 1 General Requirements, and Drawings are applicable to this Section.
- B. Division 06 Section "Rough Carpentry" for blocking in frame walls required to anchor casework.

1.03 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI A208.1 – Particleboard.
- B. American Society of Civil Engineers (ASCE):
 - 1. ASCE 7 – Minimum Design Loads for Buildings and Other Structures.
- C. ASTM International (ASTM):
 - 1. ASTM C 423 – Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - 2. ASTM E 488 – Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements.
 - 3. ASTM E 795 – Standard Practices for Mounting Test Specimens During Sound Absorption Tests.
- D. GREENGUARD Environmental Institute (GEI):
 - 1. GREENGUARD certified low emitting products.
- E. Audio Engineering Society (AES):
 - 1. AES-4id – AES information document for room acoustics and sound reinforcement systems -- Characterization and measurement of surface scattering uniformity.
- F. Builders Hardware Manufacturers Association (BHMA):
 - 1. ANSI/BHMA A156.9 – Cabinet Hardware.
- G. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA LD 3 – High Pressure Decorative Laminates.
- H. U.S. Department of Commerce, National Institute of Standards and Technology (NIST):
 - 1. DOC PS 1 – U.S. Product Standard for Construction and Industrial Plywood.
- I. California Air Resources Board (CARB).
- J. California 93120 – Formaldehyde Emissions Phase I.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets, installation instructions, and maintenance recommendations.
- C. Shop Drawings: Prepared by manufacturer. Include elevations showing casework components, details of each condition of installation, and types and locations of hardware and fasteners. Show fabrication and installation details. Include plans, elevations, sections, details, and attachments to other Work.
- D. Samples: For each color and finish for each exposed casework component.
- E. Operation and Maintenance Data.

F. Warranty: Submit sample meeting warranty requirements of this Section.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Approved manufacturer listed in this section, with minimum 5 years experience in manufacture of similar products in use in similar environments. Obtain music education storage casework through one source from a single approved manufacturer.
1. Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time period allowed for substitution review:
 - a. Product data, including certified independent test data indicating compliance with requirements for acoustical performance.
 - b. Samples of each type of product specified, including but not limited to the following:
 - 1) Schedule 1 Door and casework panels.
 - 2) Schedule 2 Grille doors.
 - 3) Schedule 3 Hinges with through-bolting hardware.
 - 4) Schedule 4 Latches with through-bolting hardware.
 - c. Project references: minimum of 5 installations not less than 5 years old, with owner contact information.
 - d. List of successful installations of similar products available for evaluation by Architect.
 - e. Sample warranty.
 2. Submit substitution request not less than 15 days prior to bid date. Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements.
 3. Approved manufacturers must meet separate requirements of Submittals Article.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle music education storage casework in accordance with manufacturer's recommendations. Ship to jobsite only after roughing-in, painting work, and other related finish work has been completed and installation areas are ready to accept casework and recommended temperature and humidity levels will be maintained during the remainder of construction.

1.07 COORDINATION

- A. Coordinate installation of blocking and supports in frame wall assemblies under work of other sections where required for anchoring of music education storage casework.
- B. Project Environmental Requirements
1. Comply with requirements of referenced standards and recommendations of material manufacturers for environmental conditions before, during, and after installation.
 2. Do not begin installation until building is completely enclosed and HVAC system is operating and maintaining temperature and humidity conditions consistent with "after occupancy" conditions for a minimum of 2 weeks.
 3. Maintain continuous and uniform building temperatures of not less than 50 degrees F during installation nor more than 85 degrees F.
 4. Environmental Requirements: Do not install cabinets until all mortar, wet and dust producing work is completed.
 5. Field Measurements: Obtain required field measurements from the Contractor and indicate on Shop Drawings.

1.08 WARRANTY

- A. Special Warranty: Manufacturer's written warranty indicating manufacturer's intent to repair or replace components of music education storage casework that fail in materials or workmanship within 10 years from date of Substantial Completion. Failures are defined to include, but are not limited to, the following:

1. Fracturing or breaking of casework components including doors, panels, shelves, or hardware resulting from normal wear and tear and normal use other than vandalism.
2. Delamination or other failures of glue bond of components.
3. Warping of casework components not resulting from leaks, flooding, or other uncontrolled moisture or humidity.
4. Failure of operating hardware.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Wenger Corporation; www.wengercorp.com.
- B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 CABINET SYSTEM

- A. System Description:
 1. Modular instrument storage casework with integral bases, adjustable levelers, and through-bolted fastening, enabling owner reconfiguration of unit layout.
 2. Acoustically enhanced instrument storage casework finished with interior lining of sound-absorbent material providing sound absorption and noise reduction properties.
- B. Performance Requirements:
 1. Acoustically Enhanced Music Instrument Storage Casework Acoustic Properties:
 - a. Sound Absorption Average: Minimum SAA of 0.80, based upon sound absorption coefficient for twelve one-third octave bands from 200 to 2500 Hz, inclusive, with a minimum Noise Reduction Coefficient (NRC) of 0.75, per ASTM C 423 and ASTM E 795.
 - b. Acoustical Performance, One-third Octave Band Center Frequency, Hz, for four: 27 by 84 by 29 inch deep (606 by 2134 by 737 mm deep) units:

	<u>125</u>	<u>250</u>	<u>500</u>	<u>1000</u>	<u>2000</u>	<u>4000</u>
<u>Sound Absorption Coefficient</u>						
Mounting Type F65	1.08	0.71	0.86	0.77	0.75	0.68
<u>Sound Absorption, sabins/unit</u>						
Mounting Type F65	68.72	45.25	55.00	48.83	47.85	43.45
<u>Scattering Coefficient</u>						
	0.10	0.13	0.40	0.62	0.80	1.44

2. Storage Casework Component Load Capacities:
 - a. Storage Casework Wire-Grille Door Hinge: Each weld capable of resisting 400 lbf (1779 N) pull test without visible damage or permanent deformation.

2.03 MATERIALS

- A. Particleboard: ANSI A208.1, minimum 45 lb/cu. ft. (721 kg/cu. m) density.
- B. Particleboard Thermoset Panels: Particleboard finished with thermally-fused polyester surfacing on both sides meeting performance properties of NEMA LD 3 for VGS grade, edge-banded, including the following:
 1. Surface Abrasion Resistance: Taber Wheel, 400 cycles, for solid colors.
- C. Polyethylene Shelves: High-density, one-piece, blow-molded or polyethylene, with radiused front edge, for abuse-resistant shelves.
- D. PVC Edge Banding: Radiused PVC extrusions, 3 mm thick.

2.04 INSTRUMENT STORAGE CASEWORK

- A. General: Provide through-ventilating instrument storage casework meeting requirements in System Description and Performance Requirements Articles.

- B. Side Panels and Divider Panels: Particleboard thermoset panel with no urea formaldehyde added, 3/4 inch (19 mm) thick. Side panels machined to accept unit-to-unit through-bolting.
- C. Panel Edge Banding: 3 mm thick, heat-bonded, with radiused and profiled edges and corners.
- D. Grille Doors: Bright basic steel wire, 5/16 and 3/16 inch (7.9 and 4.8 mm) diameter, or 5/16 and 1/4 inch (7.9 and 6.3 mm) diameter for AcoustiCabinets, with full 360 degree welds at T-joints.
 - 1. Provide for Instrument Storage Casework
- E. Panel Edge Banding: 3 mm thick, heat-bonded, with radiused and profiled edges and corners.
- F. Shelving: Sized with adequate gap between shelving and casework side panels to allow air movement inside casework.
 - 1. Up to 27 inches (686 mm) wide: Removable molded polyethylene shelf, with impact-resistant, radiused front edge, mounted to cabinet wall with self-locking clip.
 - 2. Over 27 inches (686 mm) wide: For large instrument casework: Removable formed polyethylene shelf, ribbed, with high-impact-resistant, radiused front edge, supported by steel tube frame.
 - 3. Corner cabinet revolving shelving: 0.053 inch (1.3 mm) min. thickness steel sheet bolted to revolving steel center post, with radiused hardboard deflector panel.
- G. Casework Panel Color: As selected by Architect from manufacturer's standard colors.

2.05 ACCESSORIES

- A. Filler Panels and Closure Kits: 3/4 inch (19 mm) thick particleboard thermoset panels with no urea formaldehyde added matching cabinet side panels. Provide the following, cut to fit field conditions, where indicated:
 - 1. Wall filler between cabinet side and wall.
 - 2. Top filler between cabinet top and wall.
 - 3. Top of cabinet closure panel between cabinet and finished ceiling or soffits.
 - 4. Finished back panel for exposed cabinet backs.

2.06 HARDWARE

- A. Butt Hinges: 2-3/4 inch (70 mm), 5-knuckle steel hinges made from 0.090 inch (2.29 mm) thick metal, ANSI/BHMA A156.9, Grade 1, with powder-coated finish, through-bolted to door and side panels and welded to grille door frames. Provide 2 hinges on compartment doors, and 4 hinges on full-height doors.
- B. Slide Latch: 0.105 inch (2.67 mm) min. thickness steel, with padlock eye, powder-coat finish, through-bolted to panel door and side panel and welded to grille door frames. Latches securely without padlock. Provide with clear plastic label holder with numbering system. Padlocks furnished by Owner.
- C. Panel Connectors: 1/4-20 by 1.77 inch (45 mm) panel connectors, with steel thread inserts, powder coated to match panels.
- D. Cabinet Levelers: Leveling glides with 3/8 inch (9.5 mm) diameter threaded steel rod in steel corner brackets, minimum two each per cabinet side, accessible from within unit, and concealed in completed installation.
- E. Fasteners: Manufacturer-recommended fasteners as required for casework substrate and project performance requirements, consisting of one or more of the following:
 - 1. Sheet Metal Screws: SAE J78, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
 - 2. Wood Screws: ASME B18.6.1.
 - 3. Expansion Anchors in Concrete and Concrete Masonry Units: Carbon-steel, zinc plated.

2.07 FINISHES

- A. Steel Sheet, Steel Wire, and Exposed Fasteners: Urethane-based electrostatic powder coating, color as indicated.
- B. Refer to Section 01 6210 - Schedule of Materials and Colors for approved color selection.

PART 3 EXECUTION

3.01 PREPARATION

- A. Examine casework installation areas for compliance with requirements for installation tolerances, location of blocking and other anchoring reinforcements, and other existing conditions affecting installation and performance of casework. Proceed with casework installation upon correction of unsatisfactory conditions.

3.02 CASEWORK INSTALLATION

- A. Install plumb, level, and true; using integral levelers. Install in accordance with manufacturer's recommendations and approved submittals.
- B. Install hardware uniformly and precisely. Set hinges snug and flat. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.
- C. Adjust casework and hardware so doors and drawers operate smoothly without warp or bind and close with uniform reveals.

3.03 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

3.04 CLEANING

- A. Clean casework surfaces. Touch up, refinish, or replace damaged components in a manner acceptable to Architect.

3.05 PROTECTION

- A. Protect work so that it will be without any evidence of damage or use at time of acceptance.
- B. Repair or replace defective work as directed by Architect upon inspection.
- C. Turn over operation and maintenance instructions to Owner.

END OF SECTION

**SECTION 12 3600
COUNTERTOPS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Countertops for manufactured casework.
 - 1. Plastic Laminate Countertops.
 - 2. Natural Quartz Countertops.

1.02 RELATED REQUIREMENTS

- A. Section 12 3200 - Manufactured Wood Casework.

1.03 REFERENCE STANDARDS

- A. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications; 2016.
- B. ANSI/AWI 0641 - Architectural Wood Casework Standard; 2019.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.
- D. ISFA 3-01 - Classification and Standards for Quartz Surfacing Material; 2013.
- E. MIA (DSDM) - Dimensional Stone Design Manual, Version VIII; 2016.
- F. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation and countertop seaming ; combine with shop drawings of cabinets and casework specified in other sections.
- D. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.
- E. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 MOCK-UPS

- A. Provide as part of casework specified in 12 3200-Manufactured Wood Casework.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience and approved by manufacturer.
- B. Perform cabinet construction in accordance with ANSI/AWI 0641 - Architectural Woodwork Standards.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.08 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOPS

- A. Quality Standard: See Section 12 3200.
- B. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
 - 1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch nominal thickness.
 - a. Manufacturers:
 - 1) Arborite: www.arborite.com/#sle.
 - 2) Formica Corporation: www.formica.com/#sle.
 - 3) Lamin-Art, Inc: www.laminart.com/#sle.
 - 4) Panolam Industries International, Inc\Nevamar: www.nevamar.com.
 - 5) Panolam Industries International, Inc\Pionite: www.pionite.com.
 - 6) Wilsonart: www.wilsonart.com/#sle.
 - 7) Substitutions: See Section 01 6000 - Product Requirements.
 - b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
 - c. NSF approved for food contact.
 - d. Wear Resistance: In addition to specified grade, comply with NEMA LD 3 High Wear Grade requirements for wear resistance.
 - e. Finish: Matte or suede, gloss rating of 5 to 20 or as scheduled in the Schedule of Materials and Colors.
 - f. Surface Color and Pattern: See Drawings and Section 01 6210 - Schedule of Materials and Colors.
 - 2. Exposed Edge Treatment: 3 mm Molded PVC edge with T-spline, sized to completely cover edge of panel.
 - a. Color: Color match to face laminate.
 - 3. Back and End Splashes: Same material, same construction.
 - 4. Fabricate in accordance with manufacturer's standard requirements.
- C. Natural Quartz and Resin Composite Countertops: Sheet or slab of natural quartz and plastic resin self-supporting over structural members.
 - 1. Flat Sheet Thickness: 3/4 inch, minimum.
 - 2. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISFA 3-01 and NEMA LD 3; orthophthalic polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
 - a. Manufacturers:
 - 1) Cambria Company LLC: www.cambriausa.com/#sle.
 - 2) Dal-Tile Corporation: www.daltile.com/#sle.
 - 3) Terrazzo & Marble Supply Companies: www.tmsupply.com/#sle.
 - 4) Dupont: www.corian.com/#sle.
 - 5) Wilsonart: www.wilsonart.com/#sle.
 - 6) Substitutions: See Section 01 6000 - Product Requirements.
 - b. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with the MIA Dimension Stone Design Manual.
 - c. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.

- d. NSF approved for food contact.
 - e. Finish on Exposed Surfaces: See Drawings and Section 01 6210 - Schedule of Materials and Colors.
 - f. Color and Pattern: As Scheduled.
- 3. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; square edge.
 - 4. Back and End Splashes: Same sheet material, 1/2 inch thick maximum, square top; minimum 4 inches high.
 - 5. Fabricate in accordance with manufacturer's standard requirements.
- D. All exposed corners to be 1.5 inch radius.

2.02 MATERIALS

- A. Medium Density Fiberboard for Supporting Substrate: ANSI A208.2.
 - 1. 1-1/8" MDF, for tops without sinks.
 - 2. 1-1/8" MDF, meets or exceeds ANSI grade MR10 (moisture resistant) for tops with sinks.
- B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- C. Joint Sealant: Mildew-resistant silicone sealant, color to match counter.

2.03 FABRICATION

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
 - 1. Join lengths of tops using best method recommended by manufacturer.
 - a. No splices on countertop plastic laminate material less than 144" will be permitted.
 - 2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
 - 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
 - 4. All countertops shall have radius corners of 1.5" or more.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated on drawings.
 - 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
 - 2. Height: 4 inches, unless otherwise indicated.
- C. Solid Surfacing: Fabricate tops up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.
- D. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings and finished as scheduled..

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.
- C. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

- A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
- B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
- C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING

- A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

**SECTION 13 3416
GRANDSTANDS AND BLEACHERS**

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Non-Elevated Angle Frame Bleachers

1.02 RELATED REQUIREMENTS

- A. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 01 of these Specifications.
- B. Section 00 3132 – Geotechnical Data.
- C. Section 01 4100 – Regulatory Requirements.
- D. Section 03 3000 – Cast-In-Place Concrete.

1.03 REFERENCE STANDARDS

- A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
- B. AISC Steel Construction Manual.
- C. Aluminum Association (AA) Aluminum Design Manual.
- D. ASTM A 36 / A 36M - Standard Specification for Carbon Structural Steel.
- E. ASTM A 123 / A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- F. ASTM A 307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60?000 PSI Tensile Strength.
- G. ASTM A 325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- H. ASTM A 529 / A 529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality.
- I. ASTM A 992 / A 992M - Standard Specification for Structural Steel Shapes.
- J. AWS D1.1 / D1.1M - Structural Welding Code - Steel.

1.04 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Manufacturer Qualifications: Manufacturers must have ten years of experience in the manufacture of bleachers and grandstands; welders must be AWS certified.
- C. Installer Qualifications: Experienced in the proper installation of grandstands.
- D. Source Quality Control: Mill Test Certification.

1.05 SUBMITTALS

- A. Comply with pertinent provisions of Section 01 3000 – Administrative Requirements.
- B. Product data: Within 15 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
- C. Manufacturer's Product Data: Submit manufacturer's descriptive product data for project.
- D. Shop Drawings: Manufacturer to submit shop drawings sealed by a registered professional engineer and schedules for type, location, quantity, and details of steel and aluminum components required for project.

- E. Shop drawing sheets that include engineering information designed by the Contractor's Delegated Design Engineer shall be signed and sealed in accordance with the Texas Engineering Practice Act. Sheets that do not provide information designed by the Contractor's Engineer do not require being signed and sealed. Calculation packages require a signed and sealed cover sheet only. Any submittals requiring to be signed and sealed that are received without the signature and seal will be rejected without review.
- F. Product Sample: Submit one 18-inch seat sample.
- G. Color Sample: If applicable, submit sample.
- H. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.

1.06 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01 6000 – Product Requirements.

1.07 WARRANTY

- A. Grandstands/Bleachers shall be under warranty for a period of one year beginning at Date of Substantial Completion. The system is warranted to be free from defect in materials and workmanship in the course of manufacture.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Southern Bleacher Company: www.southernbleacher.com
- B. Sturdi-Steel: www.sturdisteel.com.
- C. Equal products of other manufacturers with Architect's approval prior to bidding.

2.02 DESIGN REQUIREMENTS

- A. Provide labor, material, equipment and supervision necessary to complete installation of pre-engineered grandstands and bleachers including, but not limited to the following: steel substructure, decking system, concrete foundation/piers and support structure. This scope is a performance-based specification. The scope includes all design and installation as required for a complete installation. A full copy of the geotechnical report copy has been included in the project manual. Design shall comply with all applicable codes and accessibility regulations.
- B. Design: Conform to AISC Steel Construction Manual and AA Aluminum Design Manual.
- C. Applicable Codes: Design and workmanship shall be in accordance with IBC 2012 and ICC 300 Bleachers, Folding and Telescopic Seating, and Grandstands.
- D. Design Loads:
 - 1. Live Loads:
 - a. Uniform Loading, Structure: 100 psf.
 - b. Uniform Loading, Seats: 120 plf.
 - 2. Sway Loads:
 - a. Perpendicular to Seats: 10 plf.
 - b. Parallel to Seats: 24 plf.
 - 3. Wind Loads: Local building code.
 - 4. Snow Loads: Local building code.
 - 5. Seismic Loads: Local building code.
 - 6. Handrail and Guardrail: 250 lbs. concentrated in any direction.
- E. Shop Connections: Welded and capable of carrying stress put upon them.
- F. Welding: AWS D1.1.

- G. Concrete Foundations: Manufacturer shall design and install concrete foundations as specified in Section 03 3000.

2.03 ANGLE FRAME-TYPE BLEACHERS - NON-ELEVATED

A. Product Description

1. Non-Elevated Frame-Type Bleachers:

- a. Rise and Depth Dimensions: Vertical rise and horizontal depth per row: 8 inches x 24 inches. Seat is 17 inches above its respective tread.
- b. Framework: Prefabricated angle bleacher frames are spaced at 6-foot (max.) intervals and connected by cross-braces.
- c. Seats: Nominal 2 x 10 anodized aluminum plank with 2 x 10 anodized end caps.
- d. Treads: Two nominal 2 x 11 mill aluminum planks with 2 x 11 anodized end caps.
- e. Risers: Nominal 1 x 6-1/2 anodized aluminum riser plank beginning at Row 2; two 1 x 6-1/2 aluminum riser plank on top row.
- f. Guard-railing: Two lines of aluminum rail with chain link 48 inches above seat on both sides of bleacher and across back of bleacher. Guard-railing at all locations shall have members that will not allow a 4" diameter sphere to pass through.
- g. Aisle: Aisle to be provided with 34" high handrail and intermediate rail at approximately 22" above tread. Handrails with rounded ends are discontinuous to allow access to seating through a 24" wide space. Aluminum tread nosing of contrasting color on aisle steps.
- h. Wheelchair Area:
 - 1) Wheelchair area to be 5' 6" wide for two wheelchairs (33" each) and 36" for single.

B. Materials and Finishes

1. Framework:

- a. Galvanized Steel: Structural fabrication with ASTM-A529 steel. Shop connections are seal welded. After fabrication, all steel is hot-dipped galvanized to ASTM-A123 specification. All steel and fabrication shall conform to AISC.

2. Extruded Aluminum:

- a. Seat Planks, Riser Planks, Step Risers: Extruded aluminum alloy 6063-T6, clear anodized 204R1, AA-M10C22A31, Class II.
- b. Tread Planks: Extruded aluminum alloy 6063-T6, mill finish.

3. Accessories:

- a. Channel End Caps: Aluminum alloy 6063-T6, clear anodized 204R1, AA-M10C22A31, Class II.
- b. Hardware:
 - 1) Bolts, Nuts: Galvanized or plated.
 - 2) Hold-Down Clip Assembly: Aluminum alloy 6061-T6.
- c. Guard-railing: Anodized aluminum rail 1-5/8" O.D. with galvanized chain link. Guard-railing at all locations shall have members that will not allow a 4" diameter sphere to pass through.
- d. Cross-braces: Extruded aluminum angle alloy 6061-T6, mill finish.
- e. Aisle Nose: Aluminum alloy, 6063-T6, black powder-coat finish.

C. Fabrication

1. Design Load:

- a. Live Load: 100 psf gross horizontal projection
- b. Lateral Sway Load: 24 plf seat plank
- c. Perpendicular Sway Load: 10 plf seat plank
- d. Live Load of Seat and Tread Plank: 120 plf
- e. Guardrail: 100 plf vertical and 50 plf horizontal.

2. All connections made in shop to be shop welded.
 - a. Manufactured by certified welders conforming to AWS Standards.

PART 3 – EXECUTION

3.01 GENERAL

- A. All workmanship must be first-class in all respects and any members not presenting a finished and workmanlike appearance will be rejected. All finished members shall be free from twists, bends or open joints.
- B. All members shall be true to length so that assembly may be done without fillers, except where same are required as detailed. There shall be no projecting edges or corners where different members are assembled. All coping, blocking or mitering shall be done with care. Shop edges and corners caused by shearing or other tooling shall be eased where exposed.
- C. All details and connections shall be close fitting and carefully made and fitted, and special care shall be exercised to product a thoroughly neat and workmanlike appearance. All detail pieces shall be made in exact accordance with Detail Drawings, with all projecting corners clipped and all filler pieces made flush. Provide all lugs, clips, connections, rivets, bolts, etc. necessary to complete fabrication and erection.
- D. Clean up all debris caused by work of this Section, keeping the premises clean and neat at all times.
- E. The angle frame bleacher units shall be securely anchored to the concrete foundation.

END OF SECTION

**SECTION 13 3419
METAL BUILDING SYSTEMS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes a single-story, single-span, single slope, rigid-frame-type pre-engineered metal building of the nominal length, width, eave height, and roof pitch indicated.
1. Exterior walls are covered with field-assembled wall panels attached to framing members using exposed fasteners. Endwalls are not expandable.
 2. Roof system consists of the manufacturer's standard standing-seam insulated roof.
 3. Manufacturer's standard building components and accessories may be used, provided components, accessories, and complete structure conform to design indicated and specified requirements.
- B. Related Sections: The following sections contain requirements that relate to this section:
1. Concrete floor and foundations and installation of anchor bolts are specified in Division 03 Section "Concrete Work."
 2. Sealants and caulking are specified in Division 07 Section "Joint Sealers."
 3. Finish hardware and provisions for masterkeying are specified in Division 08 Section "Finish Hardware."

1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. General: Engineer, design, fabricate and erect the pre-engineered metal building system to withstand loads from winds, gravity, structural movement including movement thermally induced, and to resist in-service use conditions that the building will experience, including exposure to the weather, without failure.
1. Design each member to withstand stresses resulting from combinations of loads that produce the maximum allowable stresses in that member as prescribed in MBMA's "Design Practices Manual."
- B. Design Loads: Basic design loads, as well as auxiliary and collateral loads, are indicated on the drawings.
1. Basic design loads include live load, wind load, and seismic load, in addition to the dead load.
- C. Structural Framing and Roof and Siding Panels: Design primary and secondary structural members and exterior covering materials for applicable loads and combinations of loads in accordance with the Metal Building Manufacturers Association's (MBMA) "Design Practices Manual."
1. Structural Steel: Comply with the American Institute of Steel Construction's (AISC) "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" for design requirements and allowable stresses.

2. Light Gage Steel: Comply with the American Iron and Steel Institute's (AISI) "Specification for the Design of Cold Formed Steel Structural Members" and "Design of Light Gage Steel Diaphragms" for design requirements and allowable stresses.
 3. Welded Connections: Comply with the American Welding Society's (AWS) "Standard Code for Arc and Gas Welding in Building Construction" for welding procedures.
- D. Building Accessories: Provide metal building system accessories that comply with the following criteria:
1. Hollow Metal Doors and Frames: Comply with the Steel Door Institute's SDI-100 for types, styles, and design requirements and with ANSI A115 for hardware preparation.

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of the Contract and Division 1 Specification Sections.
- B. Product data consisting of metal building system manufacturer's product information for building components and accessories.
- C. Shop drawings for metal building structural framing system, roofing and siding panels, and other metal building system components and accessories that are not fully detailed or dimensioned in manufacturer's product data.
1. Structural Framing: Furnish complete erection drawings prepared by or under the supervision of a professional engineer legally authorized to practice in the jurisdiction where the Project is located. Include details showing fabrication and assembly of the metal building system. Show anchor bolts settings and sidewall, endwall, and roof framing. Include transverse cross-sections.
 2. Roofing and Siding Panels: Provide layouts of panels on walls and roofs, details of edge conditions, joints, corners, custom profiles, supports, anchorages, trim, flashings, closures, and special details. Include transverse cross-sections.
 3. Building Accessory Components: Provide details of metal building accessory components to clearly indicate methods of installation including the following:
 - a. Personnel doors: Provide elevations and details of each type of door and frame, including anchors and reinforcement; show location and installation requirements for finish hardware. Provide schedule of doors and frames using the same reference numbers for details and openings as those indicated on the drawings; include complete hardware schedule.
 - b. Overhead Coiling Service Doors: Provide fully dimensioned details of construction, including 1/4-inch scale elevations of door units and not less than 3/4-inch scale details showing door curtain, guides, counterbalance, and method of operation.
 - c. Sheet Metal Accessories: Provide layouts at 1/4-inch scale. Provide details of ventilators, louvers, gutters, downspouts, and other sheet metal accessories at not less than 1-1/2-inch scale showing profiles, methods of joining, and anchorages.
- D. Wiring diagrams from the manufacturer of motor operated overhead service doors detailing power, signal, and control systems differentiating clearly between field-installed and manufacturer-installed wiring.
- E. Samples for initial selection purposes in form of manufacturer's color charts or chips showing full range of colors, textures, and patterns available for metal roofing and siding panels with factory-applied finishes.

- F. Samples for verification purposes of roofing and siding panels. Provide sample panels 12-inch long by actual panel width, in the profile, style, color, and texture indicated. Include clips, battens, fasteners, closures, and other panel accessories.
- G. Installer certificates signed by metal building manufacturer written certification certifying that the installer complies with requirements included under the "Quality Assurance" Article.
- H. Professional engineer's certificate prepared and signed by a Professional Engineer, legally authorized to practice in the jurisdiction where Project is located, verifying that the structural framing and covering panels meet indicated loading requirements and codes of authorities having jurisdiction.

1.5 QUALITY ASSURANCE

- A. Where standards or requirements of this Section are in conflict with those noted on the Contract Drawings, or the Building Code, the more stringent requirements shall govern. Bring all conflicts and discrepancies are clarified and corrected. Failure to do so will not relieve the Contractor from performing the Work correctly at no additional expense to the Owner.
- B. Installer Qualifications: Engage an experienced Installer to erect the pre-engineered metal building who has specialized in the erection and installation of types of metal buildings systems similar to that required for this project and who is certified in writing by the metal building system manufacturer as qualified for erection of the manufacturer's products.
- C. Manufacturer's Qualifications: Provide pre-engineered metal buildings manufactured by a firm experienced in manufacturing metal buildings systems that are similar to those indicated for this project and have a record of successful in-service performance.
- D. Single-Source Responsibility: Obtain the metal building system components, including structural framing, wall and roof covering, and accessory components, from one source from a single manufacturer.
- E. Design Criteria: The drawings indicate sizes, profiles, and dimensional requirements of the pre-engineered metal building system. Metal building systems having equal performance characteristics with deviations from indicated dimensions and profiles may be considered, provided deviations do not change the design concept or intended performance. The burden of proof for equality is on the proposer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver prefabricated components, sheets, panels, and other manufactured items so they will not be damaged or deformed. Package wall and roof panels for protection against transportation damage.
- B. Handling: Exercise care in unloading, storing, and erecting wall and roof covering panels to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight ventilated covering. Store metal wall and roof panels so that water accumulations will drain freely. Do not store panels in contact with other materials that might cause staining, denting or other surface damage.

1.7 WARRANTY

- A. Roofing and Siding Panel Finish Warranty: Furnish the roofing and siding panel manufacturer's written warranty, covering failure of the factory-applied exterior finish on metal wall and roof panels within the warranty period. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.
1. Warranty period for factory-applied exterior finishes on wall and roof panels is 20 years after the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering metal building systems that may be incorporated in the work include but are not limited to the following:
1. American Buildings Co.
 2. American Steel Building Co., Inc.
 3. Behlen Manufacturing Co.
 4. Bigbee Steel Buildings, Inc.
 5. Butler Manufacturing Co.
 6. Ceco Buildings Division.
 7. Dean Steel Buildings, Inc.
 8. Garco Building Systems.
 9. Kirby Building Systems, Inc.
 10. LMB Steel Structures, Inc.
 11. MBCI, an NCI Building Systems company.
 12. Mesco Metal Buildings Corp.
 13. NCI Group, Inc.
 14. Package Steel Buildings Corp.
 15. Pascoe Building Systems.
 16. Rigid Global Buildings.
 17. Southern Structures, Inc.
 18. Space Master Buildings.
 19. Star Buildings Division, H. H. Robertson Co.
 20. United Structures of America.
 21. Varco-Pruden Buildings.
 22. Whirlwind Steel Buildings, Inc.
 23. Red Dot

2.2 MATERIALS

- A. Hot-Rolled Structural Steel Shapes: Comply with ASTM A 36 or A 529.
- B. Steel Tubing or Pipe: Comply with ASTM A 500, Grade B, ASTM A 501, or ASTM A 53.
- C. Steel Members Fabricated from Plate or Bar Stock: Provide 42,000 psi minimum yield strength. Comply with ASTM A 529, ASTM A 570, or ASTM A 572.
- D. Steel Members Fabricated by Cold Forming: Comply with ASTM A 1011, Grade 50.
- E. Cold-Rolled Carbon Steel Sheet: Comply with requirements of ASTM A 366 or ASTM A 568.

- F. Hot-Rolled Carbon Steel Sheet: Comply with requirements of ASTM A 568 or ASTM A 569.
- G. Structural Quality Zinc-Coated (Galvanized) Steel Sheet: Comply with ASTM A 446 with G90 coating complying with ASTM A 525. Grade to suit manufacturer's standards.
- H. Bolts for Structural Framing: Comply with ASTM A 307 or ASTM A 325 as necessary for design loads and connection details.
- I. Translucent Panels: Glass-fiber reinforced polyester translucent plastic glazing panels complying with ASTM D3841, Type CC2, general purpose, Grade 2, weather resistant, crinkle finish both sides, weighing not less than 8 oz. per sq. ft. Match configuration of adjacent metal panels.
 - 1. Color: White.
 - 2. Mastic: Nonstaining saturated vinyl polymer as recommended by panel manufacturer for sealing laps.
- J. Thermal Insulation: Glass fiber blanket insulation, complying with ASTM C 991, of 0.5 lb per cu. ft. density, thickness as indicated, with UL flame spread classification of 25 or less, and 2 inch wide continuous vapor-tight edge tabs.
 - 1. Type: ASTM C665, Type 1
 - 2. R-Values (minimum): R-30 for roof. R-19 for walls.
 - 3. Surface Burning Characteristics:
 - a. Flame Spread: 25 or less.
 - b. Smoke Developed: 50 or less.
 - 4. Size/Thickness: 6 inch (R-19) vinyl faced over purlin, plus 8 inch (R-25) unfaced in insulation cavity; unless indicated otherwise on drawings. Vinyl side towards attic/plenum space.
 - 5. Use Gymguard insulation on the Roof/ceiling where no liner panels are specified.
 - 6. Approved Manufacturers/Products:
 - a. CertainTeed Corp. (AcoustaTherm).
 - b. Guardian Fiberglass, Inc.(Thermal Control Batts).
 - c. Johns-Manville (Thermal-SHIELD Thermal Insulation).
 - d. Knauf (Thermal Batt Insulation).
 - e. Owens-Corning (Thermal Batt Insulation).
- K. Vapor Barrier: Vinyl film.
 - 1. Retainer Strips: 26-gage (0.0179-inch) formed galvanized steel retainer clips colored to match the insulation facing.
 - 2. Shall be either a vinyl film (3.2 mil thickness) or vinyl reinforced polyester (VRP) film (3 mil approximate thickness). Vinyl reinforced polyester facing is recommended when air temperatures of 30 degrees F or below are anticipated during shipment or erection.
 - 3. Shall have an Underwriters' Laboratories flame spread rate of 25 or less and a smoke developed rating of 50 or less.
 - 4. Shall have a water vapor transmission value of 1.00 perms for vinyl film facing and 0.02 perms for VRP facing.
 - 5. Color: Shall be white.
 - 6. Width: Shall be 78 inches so as to provide a 3-inch tab projecting beyond each side of the fiberglass blanket.
- L. Paint and Coating Materials: Comply with performance requirements of the federal specifications indicated. Unless specifically indicated otherwise, compliance with compositional requirements of federal specifications indicated is not required.

1. Shop Primer for Ferrous Metal: Fast-curing, lead-free, universal primer, selected by the manufacturer for resistance to normal atmospheric corrosion, compatibility with finish paint systems, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure. Comply with FS TT-P-645.
2. Shop Primer for Galvanized Metal Surfaces: Zinc dust-zinc oxide primer selected by the manufacturer for compatibility with substrate. Comply with FS TT-P-641.

2.3 STRUCTURAL FRAMING

- A. Rigid Frames: Fabricate from hot-rolled structural steel shapes. Provide factory-welded, shop-painted, built-up "I-beam"-shape or open-web-type frames consisting of tapered or parallel flange beams and tapered columns. Furnish frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly.
 1. Provide length of span and spacing of frames indicated. Slight variations in length of span and frame spacing may be acceptable if necessary to meet manufacturer's standard.
 2. Provide rigid frames at endwalls where indicated.
- B. Primary Endwall Framing: Provide the following primary endwall framing members fabricated for field-bolted assembly:
 1. Endwall Columns: Manufacturer's standard shop-painted, built-up factory-welded "I"-shape or cold-formed "C" sections, fabricated from 14-gage (0.0747-inch) steel.
 2. Endwall Beams: Manufacturer's standard shop-painted "C"-shape roll-formed sections fabricated from 16-gage (0.0598-inch) steel.
- C. Secondary Framing: Provide the following secondary framing members:
 1. Roof Purlins, Sidewall and Endwall Girts: "C"-or "Z"-shaped sections fabricated from 16 gage (0.0598-inch) shop-painted roll-formed steel. Purlin spacers shall be fabricated from 14-gage (0.0747-inch) cold-formed galvanized steel sections.
 2. Eave Struts: Unequal flange "C"-shaped sections formed to provide adequate backup for both wall and roof panels. Fabricate from 16-gage (0.0598-inch) shop-painted roll-formed steel.
 3. Flange and Sag Bracing: 1-5/8- by 1-5/8 inch angles fabricated from 16-gage (0.0598-inch) shop-painted roll-formed steel.
 4. Base or Sill Angles: Fabricate from 14-gage (0.0747-inch) cold-formed galvanized steel sections.
 5. Secondary endwall structural members, except columns and beams, shall be the manufacturer's standard sections fabricated from 14-gage (0.0747-inch) cold-formed galvanized steel.
- D. Wind Bracing: Provide adjustable wind bracing using 1/2 inch diameter threaded steel rods; comply with ASTM A 36 or ASTM A 572, Grade D. Locate interior end bay bracing only where indicated.
- E. Bolts: Provide shop-painted bolts except when structural framing components are in direct contact with roofing and siding panels. Provide zinc-plated or cadmium-plated bolts when structural framing components are in direct contact with roofing and siding panels.

- F. Shop Painting: Clean surfaces to be primed of loose mill scale, rust, dirt, oil, grease, and other matter precluding paint bond. Follow procedures of SSPC-SP3 for power-tool cleaning, SSPC-SP7 for brush-off blast cleaning, and SSPC-SP1 for solvent cleaning.
1. Prime structural steel primary and secondary framing members with the manufacturer's standard rust-inhibitive primer.
 2. Prime galvanized members, after phosphoric acid pretreatment, with manufacturer's standard zinc dust-zinc oxide primer.

2.4 ROOF AND WALL PANEL COMPONENTS

A. Metal Roof Panels:

1. Panel Profile: Two (2) inch high by 3/4 inch wide rib by 16 inch wide, striated concealed fastener panel.
2. Metal Roof System: Vertical leg, concealed fastener, standing seam, utilizing male and female rib configurations, with factory applied hot-melt mastic in female rib, continuously locked together by an electrically powered mechanical seaming device during installation.
3. Gauge: Minimum 24 gauge (UL 90 rated)
4. Substrate: Galvalume® steel sheet, Grade "D" minimum yield of 50,000 PSI.
5. Clips: Two (2) piece floating clip, 18 gauge base, 24 gauge top, with factory applied mastic, with two (2) fasteners to structural. Comply with FM 1-90 requirements.
6. Texture: Striations.
7. Finish: Premium fluorocarbon coating produced with Kynar 500® (20 year warranty) in color selected by Architect from manufacturer's available colors.
8. Touch-up Paint: ZRC Cold Galvanizing Compound manufactured by ZRC Chemical Products, Quincy, MA; Galvax Zinc-rich Cold Galvanizing Coating manufactured by Alvin Products, Inc., Lawrence, MA; or paint complying with military specification MILP-21035A, Type I or II.
9. Approved Product / Manufacturer SuperLok® architectural structural (double-lock) standing seam metal roof system manufactured by MBCI, Houston, TX; (281) 445-8555, or Architect approved equal.

B. Metal Wall Panels (MWP-1)

1. Panel Profile: One and one quarter (1 1/4") inch high by 26 inch wide, exposed fastener panel.
2. Gauge: 24 gauge
3. Substrate: Galvalume Plus® steel sheet, Grade "D" minimum yield of 50,000 PSI.
4. Texture: Striations
5. Finish: Premium fluorocarbon coating produced with Kynar® 500 (20 year warranty) in color selected by Architect from manufacturer's available colors.

C. Metal Wall/Soffit Panels (MWP-2)

1. Panel Profile: One (1) inch high by 12 inch wide, flush face concealed fastener panel.
2. Gauge: 24 gauge
3. Substrate: Galvalume Plus® steel sheet, Grade "D" minimum yield of 50,000 PSI.
4. Texture: Striations
5. Finish: Premium fluorocarbon coating produced with Kynar® 500 (20 year warranty) in color selected by Architect from manufacturer's available colors.
6. Approved product manufacturer: FW 120-2 Metal Wall Panel Manufacturer by MBCI, Houston, TX or Architect approved equal.

2.5 ROOF ACCESSORIES

- A. Eave Gutters: Roll-formed 24 gauge steel sheet in 10 foot or longest practical length, with gutter straps, fasteners and joint sealant. Snap-on gutter straps shall be provided for ease in erection at a maximum spacing of 5 feet-0 inches. Design of the gutter will permit rapid installation or removal after roof and wall sheets are in place. Gutter shall screen the eave ends of roof sheets from view. No portion of the gutter will protrude under the roof panels. Color shall be as selected by Architect from manufacturer's full line.
- B. Downspouts: Shall be 24 gauge steel sheet in 10 foot or longest practical length, rectangular shaped with 16 gauge boot to 6'-0" above finished grade. Downspouts shall have a 45 degree elbow at the bottom and shall be supported by attachment to the wall covering at 10 feet maximum spacing. Color shall be same as wall panels.

2.7 ROOF INSULATION SYSTEM (AT CONDITIONED SPACE)

- A. Batt or Roll Thermal Insulation:
 - 1. Type: ASTM C665, Type 1.
 - 2. R-Values (minimum): R-30, total.
 - 3. Surface Burning Characteristics:
 - a. Flame Spread: 25 or less.
 - b. Smoke Developed: 50 or less.
 - 4. Size/Thickness: 6 inch vinyl faced over purlin, plus 8 inch unfaced in insulation cavity; unless indicated otherwise on drawings. Vinyl side towards attic/plenum space.
 - 5. Approved Manufacturers/Products:
 - a. CertainTeed Corp. (AcoustaTherm)
 - b. Guardian Fiberglass, Inc.(Thermal Control Batts)
 - c. Johns-Manville (Thermal-SHIELD Thermal Insulation)
 - d. Knauf (Thermal Batt Insulation)
 - e. Owens-Corning (Thermal Batt Insulation).
- B. Vapor Barrier Facing:
 - 1. Shall be either a vinyl film (3.2 mil thickness) or vinyl reinforced polyester (VRP) film (3 mil approximate thickness). Vinyl reinforced polyester facing is recommended when air temperatures of 30 degrees F or below are anticipated during shipment or erection.
 - 2. Shall have an Underwriters' Laboratories flame spread rate of 25 or less and a smoke developed rating of 50 or less.
 - 3. Shall have a water vapor transmission value of 1.00 perms for vinyl film facing and 0.02 perms for VRP facing.
 - 4. Color: Shall be white.
 - 5. Width: Shall be 78 inches so as to provide a 3-inch tab projecting beyond each side of the fiberglass blanket.
- C. Provide thermal break on top of purlin to separate structural steel and girders from aluminum roof panels.

2.8 ROOF INSULATION SYSTEM (AT CONDITIONED SPACE AT EXPOSED CEILING)

- A. System shall have an insulation R-value of 30 and an installed thickness of 8 inches. Roof system shall be a double layer system. A thermal block shall be applied where there is no existing thermal break. The Thermal break shall be 1 inch Snap-R™ thermal block. System components shall meet the following minimum specifications:
 - 1. Steel Strap:

- a. 80 KSI tempered, high-tensile-strength steel, galvanized, primed and painted the specified color on the exposed side. Minimum size shall be 0.015 x 3/4 inch x continuous length.
 - b. The strap color shall be: White.
2. Fasteners:
 - a. #12 x 3/4 inch plated Tek 2 screws, up to 1/4 inch thick, painted to match the specified color for light gauge steel.
 - b. #12 x 1-1/4 inch plated Tek 4 screws painted to match the specified color for heavier gauge steel, up to 3/8 inch thick.
 - c. Special fasteners for wood, concrete and other structure types as recommended by manufacturer shall be used when appropriate.
 3. Liner Fabric:
 - a. Shall be woven reinforced high-density polyethylene yarns coated on both sides with a continuous white polyethylene film. The fabric shall have a flame spread index of 25 or less and smoke density index of 50 or less based on ASTM E84 test standards. This material shall be manufactured in large custom pieces by extrusion welding from roll goods. Pieces shall be fabricated to substantially fit the large defined building areas with minimum practical sealing to be done on job site. Fabric shall be folded to allow for rapid pullout on the strap support system.
 - b. Liner fabric perm rating shall be: 0.025 grains/hr · sq. feet (based on ASTM E 96, procedure B, “non-inverted water method.”)
 - c. Fabric grade and color shall be: Standard white.
 4. Sealants: Shall be manufacturer’s extruded fast-tack solvent-based vapor barrier sealant, synthetic rubber adhesive for sealing vapor barrier laps and/or pressure sensitive 3/4 inch wide by 1/32 inch thick extruded vapor barrier sealant.
 5. Insulation:
 - a. Shall be fiberglass blanket or batt insulation meeting Federal specifications HH-1-588B, Form B, Type 1 or other insulation form as may be recommended and submitted by the system manufacturer and approved by the Architect during submittals.
 - b. Insulation shall be installed in two (2) layers with the lower level being 5 inches thick and the upper level being 3 inches thick for a total R-Value of 30.
 6. Insulation Hangers: Shall be manufacturer’s “FAST-R” hangers for supporting insulation between wall girts and roof purlins if roof pitch is over 4:12.
 7. Thermal Break (Block): Thermal break shall be: Manufacturer’s 1 inch polystyrene “Snap-R” thermal block. The selection shall be provided as thermal break where there is no existing thermal break.
 8. Retention Netting: Galvanized poultry wire netting of size and type recommended to suit application.
- B. Approved Manufacturer: Insulation system shall be “Simple Saver System” as manufactured by Thermal Design Inc., Madison, NE; (800) 255-0776, or comparable product.

2.8 FABRICATION

- A. General: Design prefabricated components and necessary field connections required for erection to permit easy assembly and disassembly.

1. Fabricate components in such a manner that once assembled, they may be disassembled, repackaged, and reassembled with a minimum amount of labor.
 2. Clearly and legibly mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
- B. Structural Framing: Shop-fabricate framing components to indicated size and section with base plates, bearing plates, and other plates required for erection, welded in place. Provide holes for anchoring or connections shop-drilled or punched to template dimensions.
1. Shop Connections: Provide power riveted, bolted, or welded shop connections.
 2. Field Connections: Provide bolted field connections.

PART 3 - EXECUTION

3.1 ERECTION

- A. Framing: Erect framing true to line, level, plumb, rigid, and secure. Level base plates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use a nonshrinking grout to obtain uniform bearing and to maintain a level base line elevation. Moist cure grout for not less than 7 days after placement.
- B. Purlins and Girts: Provide rake or gable purlins with tight-fitting closure channels and fascias. Locate and space wall girts to suit door and window arrangements and heights. Secure purlins and girts to structural framing and hold rigidly to a straight line by sag rods.
- C. Bracing: Provide diagonal rod or angle bracing in roof and sidewalls as indicated.
1. Movement-resisting frames may be used in lieu of sidewall rod bracing, to suit manufacturer's standards.
 2. Where diaphragm strength of roof or wall covering is adequate to resist wind forces, rod or angle bracing will not be required.
- D. Framed Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to building structural frame.

3.2 ROOFING AND SIDING

- A. General: Arrange and nest sidelap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line. Protect factory finishes from damage.
1. Field cutting of exterior panels by torch is not permitted.
 2. Provide weatherseal under ridge cap. Flash and seal roof panels at eave and rake with rubber, neoprene, or other closures to exclude weather.
- B. Standing-Seam Roof Panel System: Fasten roof panels to purlins with concealed clip in accordance with the manufacturer's instructions.
1. Install clips at each support with self-drilling fasteners.
 2. At end laps of panels, install tape calk between panels.
 3. Install factory-calked cleats at standing-seam joints. Machine-seam cleats to the panels to provide a weathertight joint.

- C. Wall Sheets: Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete and elsewhere as necessary for waterproofing. Handle and apply sealant and backup in accordance with the sealant manufacturer's recommendations.
 - 1. Align bottom of wall panels and fasten panels with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws. Fasten window and door frames with machine screws or bolts. When building height requires two rows of panels at gable ends, align lap of gable panels over wall panels at eave height.
 - 2. Install screw fasteners with power tools having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
 - 3. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
- D. Sheet Metal Accessories: Install gutters, downspouts, ventilators, louvers, and other sheet metal accessories in accordance with manufacturer's recommendations for positive anchorage to building and weathertight mounting. Adjust operating mechanism for precise operation.
- E. Hollow Metal Doors and Frames: Install doors and frames straight, plumb, and level. Securely anchor frames to building structure. Set units with 1/8-inch maximum clearance between door and frame at jambs and head and 3/4-inch maximum between door and floor. Adjust hardware for proper operation.
- F. Overhead Coiling Doors: Set doors and operating equipment complete with necessary hardware, jamb and head mold stops, anchors, inserts, hangers, and equipment supports in accordance with manufacturer's instructions. Adjust moving hardware for proper operation.
- G. Thermal Insulation: Install insulation concurrently with installation of roof panels in accordance with manufacturer's directions. Install blankets straight and true in one-piece lengths with both sets of tabs sealed to provide a complete vapor barrier. Locate insulation on underside of roof sheets, extending across the top flange of purlin members and held taut and snug to roofing panels with retainer clips. Install retainer strips at each longitudinal joint, straight and taut, nesting with roof rib to hold insulation in place.
- H. Cleaning and Touch-Up: Clean component surfaces of matter that could preclude paint bond. Touch up abrasions, marks, skips, or other defects to shop-primed surfaces with same type material as shop primer.
- I. Translucent Panels: Attach plastic panels to structural framing in accordance with the manufacturer's instructions.
 - 1. Provide end laps of not less than 6 inches and side laps of not less than 1-1/2 inch corrugations for translucent roofing panels.
 - 2. Align horizontal laps with adjacent roofing panels.
 - 3. Seal intermediate end laps and side laps of translucent panels with translucent mastic.
 - 4. Clean panels in accordance with manufacturer's instructions.

END OF SECTION

Huckabee  **MORE THAN ARCHITECTS**

PROJECT MANUAL – VOLUME 2 OF 2



2024 Cy Ranch High School Additions and Renovations

Cypress-Fairbanks Independent School District
Cypress, Texas



MORE THAN ARCHITECTS

PROJECT MANUAL

Project Name: 2024 Cy Ranch High School Additions and Renovations – Volume 2 of 2
Client Name: Cypress-Fairbanks Independent School District Location: Cypress, Texas
Project Number: 1818-06-01 Date: November 7, 2024

All inquiries shall be forwarded to Patrick Reid, Huckabee; Patrick.reid@huckabee-inc.com; 800.687.1229.

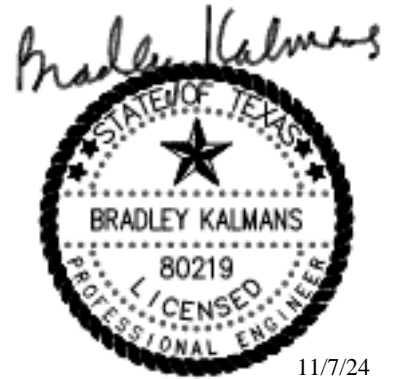
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END OF SECTION



**SECTION 21 0100
FIRE PROTECTION OPERATING AND MAINTENANCE MANUALS**

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Compilation product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified.
- B. Instruct Owner's personnel in operation and maintenance of equipment and systems.
- C. Submit three copies of complete manual in final form.

1.2 SUBMITTALS

- A. Thirty (30) days after the Contractor has received the final scheduled identified submittals bearing the Architect / Engineer's stamp of acceptance (including resubmittals), submit for review one copy of the first draft of the Operating and Maintenance Manual. This copy shall contain as a minimum:
 - 1. Table of Contents for each element.
 - 2. Contractor information.
 - 3. All submittals, coordination drawings and product data, reviewed by the Architect / Engineer; bearing the Architect / Engineer's stamp of acceptance. (When submittals are returned from Engineer "Correct as Noted", corrected inserts shall be included.)
 - 4. All parts and maintenance manuals for items of equipment.
 - 5. Warranties (without starting dates)
 - 6. Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
 - 7. Operating and maintenance procedures.
 - 8. Form of Owner's Training Program Syllabus (including times and dates).
 - 9. Control operations/equipment wiring diagrams.
 - 10. Other required operating and maintenance information that are complete.
- B. Copy will be returned to the Contractor within 15 days with comments for corrections.
- C. Submit completed manuals in final electronic form to the Architect / Engineer one day after substantial completion, and prior to Owner's instructions. Include all specified data, test and balance reports, drawings, dated warranties, certificates, reports, along with other materials and information.
- D. The Architect / Engineer will review the manuals for completeness within fifteen (15) days.
- E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.
- F. Completed electronic manuals will be delivered to the Owner.

PART 2 - PRODUCTS

2.1 BINDERS

- A. Commercial quality black three-ring binders with clear overlay plastic covers.
- B. Minimum ring size: 1".
Maximum ring size: 3".
- C. When multiple binders are used, correlate the data into related groupings.
- D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals:

1. Prepare data in form of an instructional manual for use by Owner's personnel.
 2. Format:
 - a. Size: 8-1/2" x 11".
 - b. Text: Manufacturer's printed data or neatly typewritten.
 3. Drawings:
 - a. Provide reinforced punched binder tab and bind in text.
 - b. Fold larger drawings to size of text pages.
 4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
 5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
 - a. Title of Project
 - b. Identity of separate structures as applicable.
 - c. Identity of general subject matter covered in the manual.
 6. Binder as specified.
- B. Content of Manual:
1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
 - a. Contractor, name of responsible principal, address and telephone number.
 - b. A list of each product required to be included, indexed to content of the volume.
 - c. List with each product, name, address and telephone number of:
 - 1) Subcontractor or installer
 - 2) Maintenance contractor as appropriate
 - 3) Identify area of responsibility of each
 - 4) Local source of supply for parts and replacement
 - d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
 2. Product Data:
 - a. Include those sheets pertinent to the specific product
 - b. Annotate each sheet to:
 - 1) Identify specific product or part installed
 - 2) Identify data applicable to installation
 - 3) Delete references to inapplicable information. (All options not supplied with equipment shall be marked out indicated in some manner.
 3. Drawings:
 - a. Supplement product data with drawings as necessary to illustrate:
 - 1) Relations of component parts of equipment and systems
 - 2) Control and flow diagrams
 - b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
 - c. Do not use Project Record Documents as maintenance drawings.
 4. Written text, as required to supplement product data for the particular installation:
 - a. Organize in consistent format under separate headings for different procedures.
 - b. Provide logical sequence of instructions for each procedure.
 5. Copy of each warranty, bond and service contract issued.
 - a. Provide information sheet for Owner's personnel, giving:
 - 1) Proper procedures in event of failure
 - 2) Instances that might affect validity of warranties or bonds
 6. Shop drawings, coordination drawings and product data as specified.

- C. Sections for Equipment and Systems.
1. Content for each unit of equipment and system as appropriate:
 - a. Description of unit and component parts
 - 1) Function, normal operating characteristics, and limiting conditions
 - 2) Performance curves, engineering data and tests
 - 3) Complete nomenclature and commercial number of replaceable parts.
 - b. Operating procedures:
 - 1) Start up, break-in, routine and normal operating instructions.
 - 2) Regulation, control, stopping, shut down and emergency instructions.
 - 3) Summer and winter operating instructions.
 - 4) Special operating instructions.
 - c. Maintenance procedures:
 - 1) Routine operations
 - 2) Guide to trouble-shooting.
 - 3) Disassembly, repair and reassembly.
 - 4) Alignment, adjusting and checking.
 - 5) Routine service based on operating hours.
 - d. Servicing and lubrication schedule. List of lubricants required.
 - e. Manufacturer's printed operating and maintenance instructions.
 - f. Description of sequence of operation by control manufacturer.
 - g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
 - 1) Predicted life of part subject to wear.
 - 2) Items recommended to be stocked as spare parts.
 - h. As installed control diagrams by controls manufacturer.
 - i. Complete equipment internal wiring diagrams.
 - j. Each Contractor's coordination drawings.
 - k. As installed color coded piping diagrams.
 - l. Charts of valve tag number, with location and function of each valve.
 - m. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
 - n. Other data as required under pertinent sections of the specifications.
 2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
 3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications.
 4. Provide complete information for products specified in Division 21.
 5. Provide certificates of compliance as specified in each related section.
 6. Provide start up reports as specified in each related section.
 7. Provide signed receipts for spare parts and material.
 8. Provide training report and certificates.
 9. Provide backflow preventer certified test reports.

END OF SECTION

**SECTION 21 0500
FIRE PROTECTION GENERAL PROVISIONS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions and Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 21 Fire Sprinkler Systems.
- B. Applicable provisions of this section apply to all sections of Division 22, Plumbing.

1.2 CODE REQUIREMENTS AND FEES

- A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.
- B. Plumbing work shall comply with applicable inspection services:
 - 1. Underwriters Laboratories
 - 2. National Fire Protection Association
 - 3. State Health Department
 - 4. Local Municipal Building Inspection Department
 - 5. Texas Department of Licensing & Regulations (TDLR)
 - 6. Texas Accessibility Standards (TAS Based on ADA)
- C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.
- D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.
- E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

- A. An approved contractor for the work under this division shall be:
 - 1. A licensed specialist in this field and have the personnel, experience, training, skill, and organization to provide a practical working system
 - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that has served their Owners satisfactorily for not less than 3 years

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

- A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet specified capacities.

1.5 CONTRACT DRAWINGS

- A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

1.6 PROJECT RECORD DOCUMENTS

- A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is at variance with the contract

drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various lines, valves, ductwork, traps, equipment, and other pertinent items, as installed. Include flow-line elevation of sewer lines. Record existing and new underground and under slab piping with dimensioned locations and elevations of such piping.

- B. At the conclusion of project, obtain without cost to the Owner, erasable mylars of the original drawings and transfer as-built changes to these. Prior to transmittal of corrected drawings, obtain 3 sets of blue-line prints of each drawing, regardless of whether corrections were necessary and include in the transmittal (2 sets are for the Owner's use and one set is for the Architect/Engineer's records). Delivery of these as-built prints and reproducible is a condition of final acceptance. Provide record drawings on one set each (reproducible Dayrex mylar film positives) and AutoCad 2012 / Revit CAD files on disk (CD Rom).
- C. As-Built drawings should indicate the following information as a minimum:
1. Indicate all addendum changes to documents.
 2. Remove Engineer's seal, name, address and logo from drawings.
 3. Mark documents RECORD DRAWINGS.
 4. Clearly indicate: DOCUMENT PRODUCED BY
 5. Indicate all changes to construction during construction. Indicate actual routing of all piping, etc. that were deviated from construction drawings.
 6. Correct schedules to reflect (actual) equipment furnished and manufacturer.
 7. During the execution of work, maintain a complete set of drawings and specifications upon which all locations of equipment, ductwork, piping, devices, and all deviations and changes from the construction documents in the work shall be recorded.
 8. Location and size of all ductwork and mechanical piping above ceiling including exact location of isolation of domestic and plumbing valves.
 9. Exact location of all electrical equipment in and outside of the building.
 10. Fire Protection System documents revised to indicate exact location of all sprinkler heads and zone valves.
 11. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
 12. Cloud all changes.

1.7 SPACE REQUIREMENTS

- A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.8 RELATION WITH OTHER TRADES

- A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements.
- B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.
- C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.
- D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.
- E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under that Division. Determine from the Contractor for the various trades, the Owner, and by direction from the Architect/Engineer, the exact location of all

items.

1.9 CONCEALED AND EXPOSED WORK

- A. When the word "concealed" is used in connection with insulating, painting, piping, ducts and the like, the work is understood to mean hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is understood to mean open to view.

1.10 GUARANTEE

- A. Guarantee work for 1 year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

- A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

- A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional cost. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

- A. Manufacturers names and catalog number specified under sections of Division 21 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer will be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before bid due date. Submit complete design and performance data to the Engineer.

1.14 OPERATING TESTS

- A. After all plumbing systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect/Engineer. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.15 WARRANTIES

- A. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.16 BUILDING CONSTRUCTION

- A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each sub-contractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 OPENINGS

- A. Framed, cast or masonry openings for ductwork, equipment or piping are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.2 HOUSEKEEPING PADS

- A. Provide equipment housekeeping pads under all floor mounted and ground mounted plumbing equipment, and as shown on the drawings.
- B. Concrete work as specified in Division 3.
- C. Concrete pads:
 - 1. 4" high, rounded edges, minimum 2500 psi unless otherwise indicated on the drawings
 - 2. Chamfer strips at edges and corner of forms.
 - 3. Smooth steel trowel finish.
 - 4. Doweled to existing slab
- D. Install concrete curbs around multiple pipe penetrations.

3.3 VANDAL RESISTANT DEVICES

- A. Provide a handle for each loose keyed operated valve and hose bibb on the project.
- B. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used.
- C. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.4 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to final inspection, conduct an on-site training program to instruct the Owner's operating personnel in the operation and maintenance of the plumbing systems.
 - 1. Provide the training during the Owner's regular working day.
 - 2. The Instructors shall each be experienced in their phase of operation and maintenance of building plumbing systems and with the project.
- B. Time to be allocated for instructions.
 - 1. Minimum of 4 hours dedicated instructor time.
 - 2. 2 hours on each of 2 days.
- C. Before proceeding with the on-site training program, submit the program syllabus; proposed time and dates; and other pertinent information for review and approval.
 - 1. One copy to the Owner.
 - 2. One copy to the Architect/Engineer.
- D. The Owner will provide a list of personnel to receive instructions, and will coordinate their attendance at the agreed upon times.
- E. Use the operation and maintenance manuals as the basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.
- G. Demonstrate equipment functions (both individually and as part of the total integrated system).
- H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.
- I. Submit a report within one week after completion of the training program that instructions have been satisfactorily completed. Give time and date of each demonstration and hours

- devoted to the demonstration, with a list of people present.
- J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.
 - K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.5 EQUIPMENT IDENTIFICATION

- A. Provide a laminated engraved plastic nameplate on each piece of equipment and starter.
 - 1. Designation approved by Architect/Engineer.
 - 2. Equipment includes, but is not limited to, water heaters, pumps, boilers and utility controllers.
 - 3. Submit schedule of equipment to be included and designations.
- B. Provide nameplates with 1/2" high letters and fastened with epoxy or screws.

3.6 OBSTRUCTIONS

- A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
 - 1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
 - 2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
- B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.7 PROTECTION

- A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

END OF SECTION

**SECTION 21 0510
FIRE PROTECTION CONTRACT QUALITY CONTROL**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Contract quality control including workmanship, manufacturer's instructions and demonstrations.

1.2 QUALITY CONTROL PROGRAM

- A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes to match approved samples. All exposed finishes shall be approved by the Architect. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide qualified personnel to observe:
 - 1. Field conditions.
 - 2. Condition of installation.
 - 3. Quality of workmanship.
 - 4. Start-up of equipment.
 - 5. Testing, adjusting, and balancing of equipment.
- B. Representative shall make written report of observations and recommendations to Architect / Engineer.

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.

PART 3 - EXECUTION

3.1 PROTECTION OF EQUIPMENT

- A. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the Contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

- B. Adequately protect equipment from damage after delivery to the project. Cover with heavy tarpaulins, drop cloths or other protective coverings as required to protect from plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion.

END OF SECTION

SECTION 21 0512
FIRE PROTECTION SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Prepare submittals as required by Division 1.
- B. The term submittal, as used herein, refers to all:
 - 1. Shop Drawings
 - 2. Coordination Drawings
 - 3. Product data
- C. Submittals shall be prepared and produced for:
 - 1. Distribution as specified
 - 2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

- A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
- B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.
- C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.
- D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

1.3 COORDINATION DRAWINGS

- A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: 1/4" = 1'-0".
- B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
- C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
 - 1. Actual mechanical equipment and components to be furnished
 - 2. Service clearance
 - 3. Relationship to other equipment and components
 - 4. Roof drains and leader piping
 - 5. Fire protection piping and equipment
- D. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- E. Related requirements:
 - 1. Ductwork shop drawings
 - 2. Coordination drawing specified in Division 26
- F. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.
- G. Gas piping sketch indicating proposed location of piping prior to proceeding with the installation.

1.4 PRODUCT DATA AND INSTALLATION INSTRUCTION

- A. Submit only pages which are pertinent to the project. All options which are indicated on the product data shall become part of the contract and shall be required whether specified are not.
- B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.
- C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.
- D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
- E. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: "Comply, "Do Not Comply", or "Not Applicable". Explain all "Do Not Comply" statements.
- F. Provide a separate transmittal for each submittal item. Transmittals shall indicate product by specification section name and number. Separate all submittals into appropriate specification section number. Do not combine specification sections.

1.5 MANUFACTURERS INSTRUCTIONS

- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

1.6 CONTRACTOR RESPONSIBILITIES

- A. Review submittals prior to transmittal.
- B. Determine and verify:
 - 1. Field measurements
 - 2. Field construction criteria
 - 3. Manufacturer's catalog numbers
 - 4. Conformance with requirements of Contract Documents
- C. Coordinate submittals with requirements of the work and of the Contract Documents.
- D. Notify the Architect / Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
- E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.
- F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.
- G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect / Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.
- H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
 - 1. Proper sizes and capacities
 - 2. That the item will fit in the available space in a manner that will allow proper service
 - 3. Construction methods, materials and finishes
- I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.7 SUBMISSION REQUIREMENTS

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.
- B. Number of submittals required:
 - 1. Shop Drawings and Coordination Drawings: Submit one reproducible transparency and three opaque reproductions.
 - 2. Product Data: Submit the number of copies which the contractor requires, plus those which will be retained by the Architect / Engineer.
- C. Accompany submittals with transmittal letter, in duplicate, containing:
 - 1. Date
 - 2. Project title and number
 - 3. Contractor's name and address
 - 4. The number of each Shop Drawing, Project Datum and Sample submitted
 - 5. Other pertinent data
- D. Submittals shall include:
 - 1. The date of submission
 - 2. The project title and number
 - 3. Contract Identification
 - 4. The names of:
 - a. Contractor
 - b. Subcontractor
 - c. Supplier
 - d. Manufacturer
 - 5. Identification of the product
 - 6. Field dimensions, clearly identified as such
 - 7. Relation to adjacent or critical features of the work or materials
 - 8. Applicable standards, such as ASTM or federal specifications numbers
 - 9. Identification of deviations from contract documents
 - 10. Suitable blank space for General Contractor and Architect / Engineer stamps
 - 11. Contractor's signed and dated Stamp of Approval
- E. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
 - 1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
 - 2. Associated items which require correlation for efficient function or for installation

1.8 SUBMITTAL SPECIFICATION INFORMATION

- A. Every submittal document shall bear the following information as used in the project manual:
 - 1. The related specification section number
 - 2. The exact specification section title
- B. Submittals delivered to the Architect / Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.9 RESUBMISSION REQUIREMENTS

- A. Make re-submittals under procedures specified for initial submittals.
 - 1. Indicate that the document or sample is a re-submittal
 - 2. Identify changes made since previous submittals
- B. Indicate any changes which have been made, other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

- A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
- B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect / Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.
- C. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's stamp of approval and signature.
- D. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

- A. The Architect / Engineer will:
 - 1. Review identified submittals with reasonable promptness and in accordance with schedule
 - 2. Affix stamp and initials or signature, and indicate requirements for re-submittal or approval of submittal
 - 3. Return submittals to Contractor for distribution or for resubmission
- B. Review and approval of submittals will not extend to design data reflected in submittals which is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.
- C. Architect / Engineer's review and approval is only for conformance with the design concept of the project and for compliance with the information given in the contract.
 - 1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
 - 2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.
- D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

- A. Do not make requests for substitution employing the procedures of this Section.
- B. The procedure for making a formal request for substitution is specified in Div. 1.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 21 0513
ELECTRICAL PROVISIONS OF FIRE PROTECTION WORK

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Electrical provisions to be provided as fire protection work are indicated in other Division 21 sections, on drawings, and as specified.
- B. Types of work, normally recognized as electrical but provided as fire protection, specified or partially specified in this Section, include but are not necessarily limited to the following:
 - 1. Motors for fire protection equipment.
 - 2. Starters for motors of fire protection equipment, but only where specifically indicated to be furnished integrally with equipment.
 - 3. Wiring from motors to disconnect switches or junction boxes for motors of fire protection equipment, but only where specifically indicated to be furnished integrally with equipment.
 - 4. Wiring of field-mounted float control switches, flow control switches, and similar fire protection-electrical devices provided for fire protection systems, to equipment control panels.
 - 5. Pipe heat tracing.
- C. Refer to Division 21 sections for specific individual fire protection equipment electrical requirements.
- F. Refer to Division 26 sections for motor starters and controls not furnished integrally with fire protection equipment.
- G. Refer to Division 26 sections for junction boxes and disconnect switches required for motors and other electrical units of fire protection equipment.

1.2 RELATED WORK

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to work of this Section.

1.3 QUALITY ASSURANCE

- A. Wherever possible, match elements of electrical provisions of fire protection work with similar elements of electrical work specified in Division 26 sections for electrical work not otherwise specified.
- B. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.4 SUBMITTALS

- A. Include in listing of motors, voltage, notation of whether motor starter is furnished or installed integrally with motor or equipment containing motors.

PART 2 - PRODUCTS

2.1 MOTORS

- A. Provide motors for fire protection equipment manufactured by one of the following:
 - 1. Baldor Electric Company.
 - 2. Century Electric Div., Inc.
 - 3. General Electric Co.
 - 4. Louis Allis Div.; Litton Industrial Products, Inc.
 - 5. Lincoln Electric
 - 6. Marathon Electric Mfg. Corp.
 - 7. Reliance Electric Co.

8. Westinghouse Electric Corp.
- B. Motor Characteristics. Except where more stringent requirements are indicated, and except where required items of fire protection equipment cannot be obtained with fully complying motors, comply with the following requirements for motors of fire protection work:
 - C. Temperature Rating. Rated for 40°C environment with maximum 50°C temperature rise for continuous duty at full load (Class A Insulation).
 - D. Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than 5 starts per hour for manually controlled motors.
 - E. Phases and Current Characteristics. Provide squirrel-cage induction polyphase motors for 3/4hp and larger, and provide capacitor-start single-phase motors for 1/2hp and smaller, except 1/6hp and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division 26 sections, and with individual equipment requirements specified in other Division 21 requirements. For 2-speed motors provide 2 separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.
 - F. Service Factor. 1.15 for polyphase motors and 1.35 for single-phase motors.
 - G. Motor Construction. Provide general purpose, continuous duty motors, Design "B" except "C" where required for high starting torque.
 - 1. Frames. NEMA #56.
 - 2. Bearings are to be ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual section of Division 21 for fractional-hp light-duty motors where sleeve-type bearings are permitted.
 - 3. Except as indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded drip-proof motors where exposed to contact by employees or building occupants. Provide weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division 21 for other enclosure requirements.
 - 4. Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
 - 5. Noise Rating: Provide "Quiet" rating on motors.
 - H. All motors shall be premium efficiency.

2.2 EQUIPMENT FABRICATION

- A. Fabricate fire protection equipment for secure mounting of motors and other electrical items included in work. Provide either permanent alignment of motors with equipment, or adjustable mountings as applicable for belt drives, gear drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives. Arrange for lubrication and similar running-maintenance without removal of guards.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, anchored to resist torque, drive thrusts, and other external forces inherent in fire protection work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.

- B. Verify voltage with Electrical Plans.

END OF SECTION

**SECTION 21 1000
FIRE SPRINKLER SYSTEMS**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Design coordination of sprinkler work with the installations of other trades as shown on their drawings; all mechanical, electrical, plumbing and sprinkler work must fit the space requirements. The sprinkler work shall comply with other Sections of this specification; and fit the structure finishes. The Sprinkler Contractor will comply with all the codes and underwriter authorities, and the requirements for the installation of inside and outside piping; including sprinkler heads, valves, tamper switches, flow switches, hangers and supports, sleeves, fire department connections, inspector test connections, main drain and accessories, signs and any other component parts reasonably incidental to providing a complete protection system. Provide 100 percent coverage for the entire building.
- B. A wet system shall be installed in heated areas and dry pipe systems in areas subject to freezing. When heated areas are not available and dry pipe system not used, provide heat tracing and / or insulation installed per NFPA and per local Fire Marshall Requirements, or as indicated on drawings.
- C. Furnish all articles of a completed sprinkler system including all materials, labor, tools, equipment, transportation services and supervision fees.
- D. The plans provide a riser assembly location at water entry into building for flow switch locations, valve locations (with tamper switches), fire department test assemblies and fire department Siamese connections. These are a guide for subsequent preparation of the Contractor's detailed installation drawings of the complete fire protection sprinkler system which shall be submitted to the Architect / Engineer for review. Submit only drawings and calculations bearing the approval of the authority having jurisdiction.
- E. Do not exceed 52,000 square feet of building for each individual sprinkler system.
- F. Install fire protective system identification signs in accordance with NFPA-13, NFPA-14, and NFPA-20
- G. It shall be the fire protection installer's responsibility, prior to bid, to verify pressure at the project site by performing a flow test. Determine if the available static pressure, residual pressure and flow rate will adequately provide the fire extinguishing system with the necessary operating requirements or if a fire pump, storage tank and necessary appurtenances are required. Notify Architect and Engineer if low water flow / pressure condition exist and inform them of all options prior to proceeding.
- H. The installation of the entire Sprinkler Systems shall comply with all rules and regulations of the National Board of Fire Underwriters, the Local Building Code, Local Fire Marshall, and Requirements of NFPA Pamphlet 13, and other local authorities exercising jurisdiction.
- I. Study the general, structural, electrical and mechanical drawings and specifications, in order to become familiar with the building and details as they apply to the work of this Section. Cooperate with all Trades so that there will be no conflict of space. Plumbing flow lines, large ductwork HVAC piping and electrical service feeders shall take precedence over Fire Protection work, except where it is absolutely necessary to maintain coverage protection.
- J. Provide a water curtain sprinkler system along glazing to create a 1-hour rating, as outlined in NFPA 13. Refer to Architecture plans for locations. Water demand for water curtain shall be added to the ceiling sprinkler water demand at the point of connection, per NFPA 13. Sprinkler heads shall be spaced at 6'-0" o.c., minimum 6 inches and maximum 12 inches from glazing.

1.2 BASIS OF DESIGN

- A. National Fire Protection Association (NFPA), latest edition of NFPA 13, Standard for the Installation of Sprinkler Systems.
- B. Vertical zone valves installed in horizontal position are not acceptable. All zone valves are to be located at water entry into building and mounted in the vertical riser.

1.3 QUALITY ASSURANCE

- A. Sprinkler equipment and installation to be in accordance with recommendations of and approved by local, state and federal fire authorities.
- B. Equipment and installation to meet requirements of NFPA No. 13, 14, 20, 24, 25, 70 and 72.
- C. Use materials and equipment that are new and of unused, approved by NFPA and as listed in the UL list of "Inspected Fire Protection Equipment and Materials."

1.4 SHOP DRAWINGS

- A. Make complete shop drawings and working drawings of equipment furnished, including detailed drawings of piping and sprinkler head locations. Drawings shall show construction details and dimensions of each piece of equipment and work to be installed. The location of all heads shall be as approved. Where additional heads are required to meet NFPA 13, provide at no additional cost.
- B. Before the shop drawings are submitted to Architect / Engineer, submit drawings to the jurisdictions for approval. All approvals shall be noted on the drawings or by letter from the departments.
- C. The Architect's approval of shop drawings shall not relieve the responsibility of correctly figured dimensions or any errors that may be contained in these drawings. The omission of any material shown on the contract drawings, or specified from the shop drawings, even though approved, shall not relieve the responsibility to furnish and erect them.
- D. The drawings show the location of the water entry into building. Install all zone valves at this location. Prepare the sprinkler drawings under the work of this Section.
- E. Submit samples of all sprinkler types for approval.
- F. Provide flow rates for sprinkler system and for Inspector's Sprinkler Test Drains.

1.5 ACCEPTABLE MANUFACTURERS

- A. Tyco Fire Products
 - 1. Anvil
 - 2. Gem
 - 3. Central
- B. Automatic Sprinkler Company of America
- C. Potter Roemer, Inc.
- D. The Reliable Automatic Sprinkler Company
- E. Viking Corporation
- F. Victaulic Company of America
- G. Grinnell

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

- A. Above Slab Inside Building
 - 1. Pipe 2" and Smaller: Schedule 40, black steel pipe conforming to ASTM A 795 or ASTM A135 joined with threaded fittings.
 - 2. Pipe 2-1/2" and larger, provide ASTM A795 or ASTM A135 UL and FM listed.
 - a. Schedule. 40, black steel pipe joined with rolled grooved fittings.
- B. Underground within five feet of building. Provide IBR pipe, in building riser, NFPA 24, UL/FM approved. Provide concrete thrust blocks at changes in direction, according to the pipe manufacturer's recommendations.

- C. All piping shall be black carbon steel, except in dry systems where pipe shall be galvanized per ASTM A53.
- D. Fittings used to join pipe shall be listed fabricated fittings or manufactured in accordance to the material and dimension standards listed in table 6.4.1 NFPA 13 and 2.2.1 NFPA 14.
- E. Sprinkler branch tap connections, tees, cross outlet with female threaded or grooved that requires hole drilling of main pipe is not acceptable and will not be allowed.

2.2 SPRINKLER HEAD

- A. All sprinklers shall comply with the latest requirements of NFPA 13 with respect to orifice size.
- B. All heads shall be UL listed and FM approved, and comply with the latest requirements of NFPA 13 with respect to orifice size unless otherwise noted. Sprinkler heads with “O” ring design shall not be acceptable.
- C. Exposed areas:
 - 1. Standard upright type with brass finish and escutcheon. Provide temperature rating per NFPA 13 and UL/FM approvals.
 - 2. Tyco Model B, FRB, or approved equal
- D. Sidewall applications:
 - 1. Horizontal sidewall type with brass finishes and chrome escutcheon.
 - 2. Unfinished areas and recessed with chrome plated escutcheon. Provide temperature rating per NFPA 13 and UL/FM approvals.
 - 3. Tyco Model B, FRB, or approved equal.
- E. Suspended ceilings:
 - 1. Adjustable drop down deflector type concealed heads with manufacturer painted white cover plate with glass bulb fusible link. Provide temperature rating per NFPA 13 and UL/FM approvals.
 - 2. Color of plate, selected by Architect
 - 3. Tyco Series RFII; Series ELOC, or approved equal.
- F. Dry sprinklers heads at freezers and coolers
 - 1. Tyco Model DS-1, DS-2, or approved equal.
- G. Sprinklers subject to mechanical injury shall be protected with fusible solder type sprinklers and heavy duty mechanically fastened guards. Provide Sprinkguard “Threadguard” two-piece system threads into fire line fitting; secured with two 5/16 inch bolts and Nylock nuts. Bulb type sprinklers will not be acceptable for these locations.
 - 1. Storage rooms with exposed structure.
 - 2. Gymnasiums.
 - 3. Mechanical and Electrical rooms.
 - 4. Below exposed stairs.
 - 5. Exposed structure areas.
- H. In Elevator Machine Rooms, ensure shunt trip is incorporated into the fire alarm system as per current code requirements.
 - 1. Acceptable Manufacturers
 - a. Reliable
 - b. Grinnell
 - c. Viking
- H. Systems serving walk-in freezers shall utilize Tyco Model DS-1 or DS-C dry pendent sprinklers. A Model DSB-1 dry sprinkler boot shall be utilized in conjunction with the dry sprinkler to eliminate the requirement for insulation and to stop potential air interchange. Length of dry pendent shall be determined by manufacturer’s recommendation with respect to freezer ambient temperatures expected.

2.3 INSPECTOR’S TEST CONNECTION

- A. Provide inspector's test connection as required by NFPA 13.
 - 1. Ductile iron module housing with combination sight glass, orifice and bonnet assembly
 - 2. UL listed
 - 3. Victaulic No. 718
 - 4. Tyco or approved equal
- B. Do not terminate drain valves and test drains onto sidewalks. Pipe to designated floor sink in mechanical room or route sprinkler test drain piping to specific locations as noted on Plumbing Drawings.
- C. Provide flow rates for each Inspector's Test Drain.

2.4 TAMPER SWITCH / SUPERVISORY SWITCH

- A. Tamper switch on each valve
 - 1. Controlling or shutting off sprinkler system or any portion thereof.
 - 2. Tamper switch with either one single pole, double throw switch or two single pole, double throw switches as required.
 - 3. Switch shall be compatible with installed valve for standard mounting.
 - 4. Potter-Roemer Fig. 6220, 6221, 6222, 6223 or approved equal.

2.5 FLOW SWITCH

- A. Vane type flow switch.
 - 1. Self-contained pneumatic, adjustable retard.
 - 2. Two, single pole, double throw switches.
 - 3. Red enamel tamper proof switch housing with flow paddle.
 - 4. Potter Roemer Model No. 6200, or approved equal.

2.6 FLOORS AND CEILING PLATES

- A. Provide chrome-plated floor and ceiling plates around pipes exposed to view when passing through walls, floors, partitions, or ceilings in finished areas; size plates to fit pipe or insulation and lock in place.

2.7 DOMESTIC MANUFACTURE

- A. All piping material, pipe and pipe fittings shall be manufactured in the United States of America.

2.8 DRY PIPE SYSTEM

- A. General: Provide a UL listed and FM approved dry pipe system at areas subject to freezing. System shall consist of a dry pipe valve, air compressor, fusible link type sprinkler heads and all associated trim and piping for a complete operating system.
- B. Dry Pipe Valve: Rated for a working pressure of 175 psi, factory hydrostatic tested at 350 psi, supplied with all gauges, valves, strainer, electrical alarm switch, ball drip valve, and drip cup assembly, manufactured by Victaulic Model 756.
- C. Air Compressor: Oilless, permanently lubricated, pipe mounted, direct drive, complete with safety relief valve manufactured by Reliable Model A or approved equal. Size of air compressor is determined by volume of dry pipe system. Coordinate power requirement with electrical contractor. Coordinate all wiring required with Fire Alarm System.
- D. If the dry pipe system is not used in conjunction with a wet pipe system containing the necessary check valves or backflow preventer, a check valve shall be installed in the dry pipe system at the connection to the water supply.

- E. If the dry pipe system is not used in conjunction with a wet pipe system containing a control valve such as a post indicator (PIV) or outside screw & yoke valve (OS&Y), a PIV or OS&Y shall be installed in the system.
- F. The dry pipe valve and pipe to the wet supply shall be protected from freezing.
- G. Provide an automatic or manual compressed air system capable of restoring normal air pressure to a system in 30 minutes or less.
- H. Provide an accelerator when system capacity exceeds 500 gallons.
- I. Provide a water motor alarm or electric pressure switch.
- J. Provide dry pipe valve trim and pressure gauges.
- K. Dry pipe system shall be hydraulically calculated for the hazard being protected.
- L. Provide dry pendent type sprinkler heads only when the piping and sprinklers are not in a heated area.
- M. Provide a test drain valve sized per NFPA. An inspector's test shall be provided at each system.
- N. Slope all piping toward a drain per NFPA 13. A drain shall be provided at all low points.
- O. The following accessories shall be provided where required:
 - 1. Victaulic Series 756.
 - 2. Viking Model E dry pipe valve with conventional trim.
 - 3. Viking Model D-1 accelerators.

2.9 GASKETS

- A. Use 1/16-inch thick preformed synthetic rubber bonded.

2.10 COUPLINGS

- A. Use listed rolled grooved mechanical couplings to engage and lock grooved or shouldered pipe ends and to allow for some angular deflection, contraction and expansion. Coupling consists of ductile iron housing, c-shaped composition sealing gasket and steel bolts. Gasket Material for dry pipe systems shall be silicone and listed for dry pipe service.

2.11 VALVES

- A. Use valves suitable for 175 psig WOG.
- B. Valves to be UL listed and FM approved.
- C. Valve Connections:
 - 1. Provide valves suitable to connect adjoining piping as specified for pipe joints. Use full line size valves unless noted otherwise.
 - 2. Screwed ends for pipe sizes 2 inches and smaller.
 - 3. Flanged ends for pipe sizes 2-1/2 inches and larger.
 - 4. Solder or screw to solder adapters for copper tubing.
 - 5. Use grooved body valves with mechanical grooved jointed piping.
- D. Gate Valves:
 - 1. Up to 2 inches, bronze, outside screw and yoke, rising stem, solid wedge, screwed ends, manufactured by: Mueller, or approved equal.
 - 2. Over 2 inches, iron body, bronze trim, outside screw and yoke, rising stem, solid wedge, flanged ends; manufactured by Mueller, or approved equal by Nibco, Grinnell, Stockham and Victaulic.
- E. Check Valves:
 - 1. Up to 2 inch, bronze, regrind bronze swing disk, solder or screwed ends; 200 WOG, manufactured by Mueller, or approved equal.
 - 2. Over 2 inch, iron body bronze trim, swing disk, regrind – renew bronze disk and seat, flanged ends; 200 WOG, manufactured by Mueller, or approved equal by Nibco, Grinnell, Stockham and Victaulic.

- F. Butterfly Valve: Lug body style, bubble-tight shutoff, cast iron body, ASTM B 148 bronze disk, with integral tamper switch, manufactured by Anvil Model No. 8000 FP, or approved equal.
- G. Freestanding Indicating Post: Install adjustable indicating post and valve outside building where shown on Civil drawings, consisting of UL/FM, non-rising stem gate valve and indicating post. Gate valve shall be iron body, non-rising stem, bronze mounted. Indicator flange, 175-psi non-shock rating, flanged end. Indicator shall be UL/FM approved cast iron body, Plexiglas window and 18-inch adjustment span with handle and tamper switch wired to main fire alarm control panel, manufactured by Mueller, Valve No. A-2052, Indicating Post No. A20800, or approved equal.
- H. Wall post-adjustable indicating valve: Outside building at water entry location into building, consisting of UL/FM, non-rising stem gate valve and indicator. Gate valve shall be iron body, non-rising stem, bronze mounted. Indicator flange, 175-psi non-shock rating, flanged end. Indicator shall be UL/FM approved cast iron body, Plexiglas window and 18-inch adjustment span with handle, manufactured by Mueller, Valve No. A-2052, Indicating Post No. A20800, or approved equal.

2.12 ELECTRIC ALARM BELL

- A. 10-inch round red enamel steel bell with electrically operated vibrating outdoor alarm bell, UL listed, red enamel steel, manufactured by Simplex, or approved equal.

2.13 GAUGES

- A. Gauges shall be bourdon tube type with minimum 4-1/2 inch dial and die cast aluminum case with screwed ring and black enamel finish. The movement shall be all stainless steel with Grade A phosphor bronze bourdon tube, brazed at socket and tip. The accuracy of the gauge shall be within one-half of one percent of the scale range. The pointer shall be the micrometer adjustment type recalibrated from the front. Pressure and compound gauges shall have suitable scale ranges and graduations. Suitable for temperatures up to 120 degrees F.
- B. Gauges shall have ¼ inch connections and be mounted with combination stop / snubber needle valve with suitable pressure rating. Scale ranges: 0-200 psi.
- C. Gauge range shall be such that system normal operating pressure falls with 25 percent and 75 percent of the full-scale range.
- D. Pressure scale graduations shall read in psig. Figure intervals shall be in – 20 psig increments, with minor divisions in 2 psig increments.
- E. The accuracy of the gauge shall be at least 0.5 percent of the scale range. Gauge shall be made in accordance with ASME B40.1 accuracy grade 2A.
- F. Manufactured by:
 - 1. Terice Model No. 4500 Series
 - 2. Ashcroft
 - 3. Marsh
 - 4. Weksler

2.14 SPARE SPRINKLER HEAD BOX

- A. Provide baked enamel steel box to store 36 sprinkler heads (Minimum of 3 of each type used) for emergency replacement. Provide sprinkler wrench.

2.15 ALARM CHECK VALVE

- A. Provide UL listed check valve.
 - 1. Variable for City Supplied systems pressure trim set.
 - 2. Constant for Fire Pump Systems pressure trim set.
 - 3. Tyco AV-1 or approved equal by Reliable, Grinnell and Viking.

2.16 SIAMESE FIRE DEPARTMENT CONNECTION

EDIT SELECT ONE

- A. Siamese Wall mounted chrome-plated Siamese. Include caps, sillcock, chain, and a plate lettered AUTO-SPKR.
 - 1. Provide a 4" X 2-1/2" x2-1/2".
 - 2. Potter-Roemer #5751 or approved equal by Elkhart Brass or Reliable

PART 3 - EXECUTION

3.1 DESIGN

- A. Design, spacing of sprinkler heads and selection sizes shall conform to the requirements of NFPA 13 for the indicated occupancy.
- B. Uniform discharge density design shall be based on hydraulic calculations using the method outlined in NFPA 13. Density of discharge from sprinkler heads shall conform to NFPA 13.
- C. Friction losses in pipe will be based on a value of "C" = 120 in the Hazen and Williams formula.
- D. Design and install the system so that no part will interfere with doors, windows, heating, mechanical, lighting or electrical equipment. Do not locate sprinkler heads closer than 3 feet to lighting fixtures or other obstructions.

3.2 LOCATION

- A. Heads shown, if indicated on reflected ceiling plans, are an integral part of the ceiling design. Where heads are not shown or indicated, locate them in the exact center of acoustical ceiling tile unless noted otherwise. In rooms with monolithic plaster or gypsum drywall ceilings, locate the sprinkler heads symmetrically arranged with respect to both axes of the room. Locate sprinkler heads in relation to specialty ceiling elements such as slats, ribs, panels, grids, etc., if not shown on the drawings. Generally, locate heads in the exact center of, or spaced between, such elements. Center heads in corridors.
- B. Locate heads as may be required for coordinated ceiling pattern, even through number of heads exceed minimum code requirements.
- C. Sprinkler heads located in utility or mechanical rooms, penthouses, service corridors, or other such spaces not subject to public view need not be centered in ceiling patterns and may use a straight drop from branch line.
- D. Install a water curtain sprinkler system along glazing to create a 1-hour rating, as outlined in NFPA 13. Refer to plans for locations. Water demand for water curtain shall be added to the ceiling sprinkler water demand at the point of connection, per NFPA 13. Sprinkler heads shall be spaced at 6'-0" on center, minimum 6 inches and maximum 12 inches from glazing.
- E. Where glazing shall be installed in 2-hour fire rated assemblies, the Tyco Window sprinkler shall be utilized as outlined in the ICC Legacy report equivalency requirements. Any glazing requiring fire exposure protection shall also utilize the Tyco window sprinklers.

3.3 PREPARATION

- A. Ream pipes and tubes, clean off scale, rust, oxide and dirt, inside and outside, before assembly. Remove welding slag or other foreign material from piping.
- B. Pipe beveled each end, per approved procedures.
- C. Hammer clean and flush out piping after welding to remove scale, welding slag and other debris.

3.4 CONNECTION

- A. Make screwed joints with square, clean full cut standard taper pipe threads. Ream after cutting and threading. Red lead and linseed oil or other approved non-toxic joint compound applied to male threads only.
- B. Nipples: Shoulder type; extra heavy where less than 1-1/2 inch is unthreaded.
- C. Clamp cast iron water pipe at fittings with 3/4 inch rods and properly anchor and support.
- D. Use grooved mechanical couplings and mechanical fasteners only in accessible locations.

3.5 COORDINATION

- A. Coordinate the installation schedule for this work with the construction schedule for the Work to ensure orderly progress with minimum delay.
- B. Coordinate interface of fire sprinkler system with the work of other trades to ensure proper and adequate provision for the installation and connection of this system.
- C. Coordinate location and quantity of Siamese connections required for fire department connection with Architect and local fire officials.

3.6 SURFACE CONDITIONS

- A. Before starting each stage of the fire sprinkler systems installation, inspect the installed work of other trades and determine that work is complete enough to allow installation to begin. Ensure that work of other trades has been installed in a manner to permit work of this Section in accordance with approved design.

3.7 INSTALLATION

- A. Run piping concealed above furred ceilings and in joists to minimize obstructions. Expose only heads.
- B. Protect sprinkler heads against mechanical injury with heavy duty bolt-on guards.
- C. Locate system drains and inspector's test connections to drain to floor drain inside mechanical rooms or other readily accessible areas not requiring access through ceiling. Coordinate sprinkler system drain flow rates with plumbing system drainage capacities.
 - 01. Sprinkler Contractor shall note that all sprinkler test drains, in all locations, shall be routed back to the nearest mechanical room and terminated within a floor sink or trench. All valve locations and pipe routing shall be in an accessible location. By no means shall it be acceptable for the termination to occur in other locations unless specifically noted on the MEP plans. Do not terminate drains and test drains onto sidewalks.
- D. Where low points or drains occur above ceilings or in otherwise finished spaces, furnish drain valve with brass cap and chain.
- E. Locate outside alarms on wall of building and coordinate with Architect.
- F. Fire pump and all accessories shall be tested in accordance with NFPA 20 and the local Fire Marshall and/or all other authorities having jurisdiction.
- G. Provide on interior wall near sprinkler valve, cabinet containing extra sprinkler heads of each type and wrench suitable for each head type.
- H. Provide a minimum 18-inch radius swing joint for each drop to sprinkler heads located in ceilings. NO FLEXIBLE SPRINKLER HEAD CONNECTORS ALLOWED.
- I. Install pipe markers to identify fire protection.
- J. Provide shield or deflector for sprinklers or equipment where electrical switchgear, switchboards and motor control centers are in sprinkler protected spaces.
- K. Install fire 2-1/2 inch department valve, maximum 5 feet above floor, complying with NFPA 14.
- L. During construction, make one standpipe outlet available on each floor without delay, for fire department use.
- M. Provide 3-way standpipe outlets above roof.
- N. Provide pressure gauges at the top of each standpipe as detailed on the drawings.

- O. Provide drain for each standpipe.
- P. Install valves with stems upright or horizontal, not inverted.
- Q. Sprinkler heads shall be installed above and below ductwork over 48 inches wide, in exposed areas, per NFPA 13.
- R. Install the complete fire sprinkler system in accordance with the approved shop drawings.
- S. Perform piping installation in accordance with the provisions of the specifications, including furnishing of required sleeves for fire sprinkler system pipes passing through rated walls, floors, and other parts of the building. Provide scheduled 40 galvanized pipe sleeve for concrete or CMU penetrations. Furnish size required for fireproofing and or insulation. Furnish and install split wall plates and chrome plated escutcheons for exposed fire sprinkler system pipes. Where pipes pass through concrete floors, furnish and install wrought iron or steel pipe sleeves made flush with the ceiling below and extending 2" above the finished floor.
- T. Do not cut or make holes in any part of the building except where shown on the approved shop drawings.
- U. Furnish and install, next to the sprinkler riser main, a print sheet protected by glass or a transparent plastic cover, giving brief instructions regarding control, emergency procedure, and other data required by NFPA #13. For hydraulically designed sprinkler systems, a placard is to be permanently attached to the riser indicating the location, and the basis of design (discharge density and system demand).
- V. Do not install exposed piping below structure in public area.
- W. Provide heat tracing and insulation on wet piping systems exposed to freezing when not installed in a heated space or installed by other acceptable methods of maintaining the piping from freezing. Installation of heat tracing and insulation shall be in accordance with the latest edition of NFPA 13 and the local code authorities. Coordinate electrical requirements with Division 26.
- X. Do not intrude onto or overlap into sidewalk areas with (FDC) Fire Department Connection.

3.8 SECURING AND SUPPORTING

- A. Support piping to maintain line and grade, with provision for expansion and contraction. Use approved hangers per NFPA 13 connected to structural members of the building. Do not support piping from other piping or structural joist bridging. Note that saddle clamps are not allowed and not approved for supporting piping.
- B. Provide supports both sides of elbows for pipe 6" and larger.
- C. Support vertical risers with steel strap pipe clamps of approved design and size, supported at each floor. Support piping assemblies in chases so they are rigid and self-supported before the chase is closed.
- D. Support spacing: As recommended by the project structural engineer and support manufacturer, but not more than listed below. Not to exceed spacing requirements of smallest pipe.

Pipe Size	Steel Max. Support Spacing, Feet	Minimum Rod Diameter, Inches
1" & smaller	6	3/8
1-1/4" & 1-1/2"	8	3/8
2"	10	3/8
3"	10	1/2
4" & 5"	10	5/8
6" and above	10	3/4

3.9 PIPE SUPPORTS

- A. Provide sprinkler piping supports per NFPA 13.

3.10 PIPE SLEEVES

- A. Sleeves through masonry and concrete construction:
 - 1. Fabricate sleeves of Schedule 40 galvanized steel pipe.
 - 2. Size sleeve large enough to allow for movement due to expansion and to provide continuous insulation.
- B. Sleeves through gypsum wall construction.
 - 1. Fabricate sleeves of 16 gauge galvanized sheet metal.
- C. Sleeves through elevated slab construction.
 - 1. Fabricate sleeves of Schedule 40 galvanized steel pipe with welded center flange in floor.
- D. Extend each sleeve through the floor or wall. Cut the sleeve flush with each wall surface. Sleeves through floors shall extend 2" above floor lines for waterproofing purposes. Slab on grade floors shall not be sleeved except where penetrating waterproofing membrane or insect control is required.
- E. Caulk sleeves water and airtight. Seal annular space between pipes and sleeves with mastic compound to make the space water and air tight.
- F. For sleeves below grades in outside walls, provide Thunderline Link-Seal or Advance Product and System Interlynx, with 316 stainless steel nuts and bolts, with cast iron pressure plate.
- G. Provide chrome plated escutcheon plates on pipes passing through walls, floors or ceilings exposed to view. At exterior walls, stainless steel sheet metal is to be used.
- H. For sleeves through fire and smoke rated walls, seal with a UL through-penetration firestop, rated to maintain the integrity of the time rated construction. Install in accordance with the manufacturer's installation instructions. Comply with UL and NFPA standards for the installation of firestops. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

3.11 CLEANING OF PIPING SYSTEMS

- A. General cleaning of piping systems. Purge pipe of construction debris and contamination before placing the systems in service. Provide and install temporary connections as required to clean, purge and circulate.

3.12 FLUSHING AND TESTING

- A. Testing and flushing of installation of sprinkler system shall be in accordance with NFPA 13, and NFPA 25.
- B. Flush sprinkler piping in accordance with NFPA 13. Additionally, flush all alarm valves, and all main piping up to valve.
- C. In addition to NFPA 13 required tests, provide flow switch test and tamper switch test for each device, and verify alarm valve operation.
- D. All tests shall be witnessed by Architect / Engineer. Contractor shall notify Architect / Engineer 7 working days in advance.

3.13 EXCAVATING, TRENCHING, AND BACKFILLING

- A. Perform excavation, trenching, and backfilling for this portion of the work in accordance with the specifications.

3.14 PIPE MARKERS

- A. Identify interior main piping and exposed in mechanical room piping with Opti-Code Brady Pressure Sensitive Adhesive Pipe Markers, consisting of pipe marker and direction of flow arrow tape. Clean pipe prior to installation. Background colors of markers, arrows and tape for each type of system shall be the same. Meet ANSI/OSHA standards and

clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.

- B. Install identification in the following locations:
 - 1. Both sides of penetrations through walls, floors and ceilings.
 - 2. Close to valves or flanges.
 - 3. Intervals on straight pipe runs not to exceed 50 feet
 - 4. Apply marker where view is obstructed.
- C. Pipe markers shall meet or exceed the specifications of the ASME A13.1 "Scheme for Identification of Piping Systems".

3.15 TESTING AND ACCEPTANCE

- A. Prior to connecting to the overhead sprinkler piping, flush the underground main. Secure required approvals of the flushing operations.
- B. Upon completion of the fire sprinkler system installation, test and retest the complete installation and make corrections as necessary to obtain acceptance by the Fire Marshall and/or any other authority having jurisdiction. Furnish test equipment and personnel required.

3.16 TRAINING

- A. At a time mutually agreed upon, provide 4 hours of instruction to the Owner's designated personnel on the operation and maintenance of the automatic sprinkler system and associated equipment. Owner's Operation and Maintenance Manual prepared for this project shall be used during the instruction.

END OF SECTION

**SECTION 22 0100
PLUMBING OPERATING AND MAINTENANCE MANUALS**

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Compilation product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified.
- B. Instruct Owner's personnel in operation and maintenance of equipment and systems.
- C. Submit three copies of complete manual in final form.

1.2 SUBMITTALS

- A. Thirty (30) days after the Contractor has received the final scheduled identified submittals bearing the Architect/Engineer's stamp of acceptance (including resubmittals), submit for review one copy of the first draft of the Operating and Maintenance Manual. This copy shall contain as a minimum:
 - 1. Table of Contents for each element.
 - 2. Contractor information.
 - 3. All submittals, coordination drawings and product data, reviewed by the Architect/Engineer; bearing the Architect/Engineer's stamp of acceptance. (When submittals are returned from Engineer "Correct as Noted", corrected inserts shall be included.)
 - 4. All parts and maintenance manuals for items of equipment.
 - 5. Warranties (without starting dates)
 - 6. Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
 - 7. Operating and maintenance procedures.
 - 8. Form of Owner's Training Program Syllabus (including times and dates).
 - 9. Control operations/equipment wiring diagrams.
 - 10. Other required operating and maintenance information that are complete.
- B. Copy will be returned to the Contractor within 15 days with comments for corrections.
- C. Submit completed manuals in final electronic form to the Architect/Engineer one day after substantial completion, and prior to Owner's instructions. Include all specified data, test and balance reports, drawings, dated warranties, certificates, reports, along with other materials and information.
- D. The Architect/Engineer will review the manuals for completeness within fifteen (15) days.
- E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.
- F. Completed electronic manuals will be delivered to the Owner.

PART 2 - PRODUCTS

2.1 BINDERS

- A. Commercial quality black three-ring binders with clear overlay plastic covers.
- B. Minimum ring size: 1".
Maximum ring size: 3".
- C. When multiple binders are used, correlate the data into related groupings.
- D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals:

1. Prepare data in form of an instructional manual for use by Owner's personnel.
 2. Format:
 - a. Size: 8-1/2" x 11".
 - b. Text: Manufacturer's printed data or neatly typewritten.
 3. Drawings:
 - a. Provide reinforced punched binder tab and bind in text.
 - b. Fold larger drawings to size of text pages.
 4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
 5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
 - a. Title of Project
 - b. Identity of separate structures as applicable.
 - c. Identity of general subject matter covered in the manual.
 6. Binder as specified.
- B. Content of Manual:
1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
 - a. Contractor, name of responsible principal, address and telephone number.
 - b. A list of each product required to be included, indexed to content of the volume.
 - c. List with each product, name, address and telephone number of:
 - 1) Subcontractor or installer.
 - 2) Maintenance contractor as appropriate.
 - 3) Identify area of responsibility of each.
 - 4) Local source of supply for parts and replacement.
 - d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
 2. Product Data:
 - a. Include those sheets pertinent to the specific product.
 - b. Annotate each sheet to:
 - 1) Identify specific product or part installed.
 - 2) Identify data applicable to installation.
 - 3) Delete references to inapplicable information. (All options not supplied with equipment shall be marked out indicated in some manner.
 3. Drawings:
 - a. Supplement product data with drawings as necessary to illustrate:
 - 1) Relations of component parts of equipment and systems.
 - 2) Control and flow diagrams.
 - b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
 - c. Do not use Project Record Documents as maintenance drawings.
 4. Written text, as required to supplement product data for the particular installation:
 - a. Organize in consistent format under separate headings for different procedures.
 - b. Provide logical sequence of instructions for each procedure.
 5. Copy of each warranty, bond and service contract issued.
 - a. Provide information sheet for Owner's personnel, giving:
 - 1) Proper procedures in event of failure.
 - 2) Instances that might affect validity of warranties or bonds.
 6. Shop drawings, coordination drawings and product data as specified.

- C. Sections for Equipment and Systems.
1. Content for each unit of equipment and system as appropriate:
 - a. Description of unit and component parts.
 - 1) Function, normal operating characteristics, and limiting conditions.
 - 2) Performance curves, engineering data and tests.
 - 3) Complete nomenclature and commercial number of replaceable parts.
 - b. Operating procedures:
 - 1) Start up, break-in, routine and normal operating instructions.
 - 2) Regulation, control, stopping, shut down and emergency instructions.
 - 3) Summer and winter operating instructions.
 - 4) Special operating instructions.
 - c. Maintenance procedures:
 - 1) Routine operations
 - 2) Guide to trouble-shooting.
 - 3) Disassembly, repair and reassembly.
 - 4) Alignment, adjusting and checking.
 - 5) Routine service based on operating hours.
 - d. Servicing and lubrication schedule. List of lubricants required.
 - e. Manufacturer's printed operating and maintenance instructions.
 - f. Description of sequence of operation by control manufacturer.
 - g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
 - 1) Predicted life of part subject to wear.
 - 2) Items recommended to be stocked as spare parts.
 - h. As installed control diagrams by controls manufacturer.
 - i. Complete equipment internal wiring diagrams.
 - j. Each Contractor's coordination drawings.
 - k. As installed color coded piping diagrams.
 - l. Charts of valve tag number, with location and function of each valve.
 - m. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
 - n. Other data as required under pertinent sections of the specifications.
 2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
 3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications.
 4. Provide complete information for products specified in Division 22.
 5. Provide certificates of compliance as specified in each related section.
 6. Provide start up reports as specified in each related section.
 7. Provide signed receipts for spare parts and material.
 8. Provide training report and certificates.
 9. Provide backflow preventer certified test reports.
 10. Provide gas piping pressure test reports.

END OF SECTION

SECTION 22 0500
PLUMBING GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 22 Plumbing
- B. Applicable provisions of this section apply to all sections of Division 22, Plumbing.

1.2 CODE REQUIREMENTS AND FEES

- A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.
- B. Plumbing work shall comply with applicable inspection services:
 - 1. Underwriters Laboratories
 - 2. National Fire Protection Association
 - 3. State Health Department
 - 4. Local Municipal Building Inspection Department
 - 5. Texas Department of Licensing & Regulations (TDLR)
 - 6. Texas Accessibility Standards (TAS Based on ADA)
- C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.
- D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.
- E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

- A. An approved contractor for the work under this division shall be:
 - 1. A licensed specialist in this field and have the personnel, experience, training, skill, and organization to provide a practical working system
 - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that has served their Owners satisfactorily for not less than 3 years

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

- A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet specified capacities.

1.5 CONTRACT DRAWINGS

- A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

1.6 PROJECT RECORD DOCUMENTS

- A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various lines, valves, ductwork,

- traps, equipment, and other pertinent items, as installed. Include flow-line elevation of sewer lines. Record existing and new underground and under slab piping with dimensioned locations and elevations of such piping.
- B. At the conclusion of project, obtain without cost to the Owner, erasable mylars of the original drawings and transfer as-built changes to these. Prior to transmittal of corrected drawings, obtain 3 sets of blue-line prints of each drawing, regardless of whether corrections were necessary and include in the transmittal (2 sets are for the Owner's use and one set is for the Architect/Engineer's records). Delivery of these as-built prints and reproducibles is a condition of final acceptance. Provide record drawings on one set each (reproducible Dayrex mylar film positives) and AutoCad 2012 / Revit CAD files on disk (CD Rom).
- C. As-Built drawings should indicate the following information as a minimum:
1. Indicate all addendum changes to documents.
 2. Remove Engineer's seal, name, address and logo from drawings.
 3. Mark documents RECORD DRAWINGS.
 4. Clearly indicate: DOCUMENT PRODUCED BY
 5. Indicate all changes to construction during construction. Indicate actual routing of all piping, ductwork, etc. that were deviated from construction drawings.
 6. Indicate exact location of all underground plumbing and flow line elevation.
 7. Indicate exact location of all underground plumbing piping and elevation.
 8. Indicate exact location of all underground electrical raceways and elevations.
 9. Correct schedules to reflect (actual) equipment furnished and manufacturer.
 10. During the execution of work, maintain a complete set of drawings and specifications upon which all locations of equipment, ductwork, piping, devices, and all deviations and changes from the construction documents in the work shall be recorded.
 11. Location and size of all ductwork and mechanical piping above ceiling including exact location of isolation of domestic and plumbing valves.
 12. Exact location of all electrical equipment in and outside of the building.
 13. Fire Protection System documents revised to indicate exact location of all sprinkler heads and zone valves.
 14. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
 15. Cloud all changes.

1.7 SPACE REQUIREMENTS

- A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.8 RELATION WITH OTHER TRADES

- A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements
- B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.
- C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them
- D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.
- E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under that Division. Determine from the Contractor for the various trades, the Owner, and by direction from the Architect/Engineer, the exact location of all items.

1.9 CONCEALED AND EXPOSED WORK

A. When the word "concealed" is used in connection with insulating, painting, piping, ducts and the like, the work is understood to mean hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is understood to mean open to view.

1.10 GUARANTEE

A. Guarantee work for 1 year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional cost. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

A. Manufacturers names and catalog number specified under sections of Division 22 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer will be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before bid due date. Submit complete design and performance data to the Engineer.

1.14 OPERATING TESTS

A. After all plumbing systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect/Engineer. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.15 WARRANTIES

A. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.16 BUILDING CONSTRUCTION

A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each sub-contractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 OPENINGS

- A. Framed, cast or masonry openings for ductwork, equipment or piping are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.2 HOUSEKEEPING PADS

- A. Provide equipment housekeeping pads under all floor mounted and ground mounted plumbing equipment, and as shown on the drawings.
- B. Concrete work as specified in Division 3.
- C. Concrete pads:
 - 1. 4" high, rounded edges, minimum 2500 psi unless otherwise indicated on the drawings
 - 2. Chamfer strips at edges and corner of forms.
 - 3. Smooth steel trowel finish.
 - 4. Doweled to existing slab
- D. Install concrete curbs around multiple pipe penetrations.

3.3 VANDAL RESISTANT DEVICES

- A. Provide a handle for each loose keyed operated valve and hose bibb on the project.
- B. Do not use vandal resistant screws or bolts on the project.
- C. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.4 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to final inspection, conduct an on-site training program to instruct the Owner's operating personnel in the operation and maintenance of the plumbing systems.
 - 1. Provide the training during the Owner's regular working day.
 - 2. The Instructors shall each be experienced in their phase of operation and maintenance of building plumbing systems and with the project.
- B. Time to be allocated for instructions.
 - 1. Minimum of 8 hours dedicated instructor time.
 - 2. 4 hours on each of 2 days.
- C. Before proceeding with the on-site training program, submit the program syllabus; proposed time and dates; and other pertinent information for review and approval.
 - 1. One copy to the Owner.
 - 2. One copy to the Architect/Engineer.
- D. The Owner will provide a list of personnel to receive instructions, and will coordinate their attendance at the agreed upon times.
- E. Use the operation and maintenance manuals as the basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.
- G. Demonstrate equipment functions (both individually and as part of the total integrated system).
- H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.
- I. Submit a report within one week after completion of the training program that instructions have been satisfactorily completed. Give time and date of each demonstration and hours

- devoted to the demonstration, with a list of people present.
- J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.
 - K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.5 EQUIPMENT IDENTIFICATION

- A. Provide a laminated engraved plastic nameplate on each piece of equipment and starter.
 - 1. Designation approved by Architect/Engineer.
 - 2. Equipment includes, but is not limited to, water heaters, pumps, boilers and utility controllers.
 - 3. Submit schedule of equipment to be included and designations.
- B. Provide nameplates with 1/2" high letters and fastened with epoxy or screws.

3.6 OBSTRUCTIONS

- A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
 - 1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
 - 2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
- B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.7 PROTECTION

- A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

END OF SECTION

**SECTION 22 0510
PLUMBING CONTRACT QUALITY CONTROL**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Contract quality control including workmanship, manufacturer's instructions and demonstrations.

1.2 QUALITY CONTROL PROGRAM

- A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes to match approved samples. All exposed finishes shall be approved by the Architect. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide qualified personnel to observe:
 - 1. Field conditions.
 - 2. Condition of installation.
 - 3. Quality of workmanship.
 - 4. Start-up of equipment.
 - 5. Testing, adjusting, and balancing of equipment.
- B. Representative shall make written report of observations and recommendations to Architect / Engineer.

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.

PART 3 - EXECUTION

3.1 PROTECTION OF EQUIPMENT

- A. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected,

and the Contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

- B. Adequately protect equipment from damage after delivery to the project. Cover with heavy tarpaulins, drop cloths or other protective coverings as required to protect from plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion.

END OF SECTION

SECTION 22 0512
PLUMBING SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Prepare submittals as required by Division 1.
- B. The term submittal, as used herein, refers to all:
 - 1. Shop Drawings
 - 2. Coordination Drawings
 - 3. Product data
- C. Submittals shall be prepared and produced for:
 - 1. Distribution as specified
 - 2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

- A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
- B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.
- C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.
- D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

1.3 COORDINATION DRAWINGS

- A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: $\frac{1}{4}'' = 1'-0''$.
- B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
- C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
 - 1. Actual mechanical equipment and components to be furnished
 - 2. Service clearance
 - 3. Relationship to other equipment and components
 - 4. Roof drains and leader piping
 - 5. Fire protection piping and equipment
- D. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- E. Related requirements:
 - 1. Ductwork shop drawings
 - 2. Coordination drawing specified in Division 26
- F. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.
- G. Gas piping sketch indicating proposed location of piping prior to proceeding with the installation.

1.4 PRODUCT DATA AND INSTALLATION INSTRUCTION

- A. Submit only pages which are pertinent to the project. All options which are indicated on the product data shall become part of the contract and shall be required whether specified are not.

- B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.
- C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.
- D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
- E. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: "Comply, "Do Not Comply", or "Not Applicable". Explain all "Do Not Comply" statements.
- F. Provide a separate transmittal for each submittal item. Transmittals shall indicate product by specification section name and number. Separate all submittals into appropriate specification section number. Do not combine specification sections.

1.5 MANUFACTURERS INSTRUCTIONS

- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

1.6 CONTRACTOR RESPONSIBILITIES

- A. Review submittals prior to transmittal.
- B. Determine and verify:
 - 1. Field measurements
 - 2. Field construction criteria
 - 3. Manufacturer's catalog numbers
 - 4. Conformance with requirements of Contract Documents
- C. Coordinate submittals with requirements of the work and of the Contract Documents.
- D. Notify the Architect/Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
- E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect/Engineer's acceptance.
- F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect/Engineer reviews submittals or not.
- G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect/Engineer reviews submittals or not, unless Architect/engineer gives written acceptance of the specific deviations on reviewed documents.
- H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
 - 1. Proper sizes and capacities
 - 2. That the item will fit in the available space in a manner that will allow proper service
 - 3. Construction methods, materials and finishes
- I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.7 SUBMISSION REQUIREMENTS

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.
- B. Number of submittals required:
 - 1. Shop Drawings and Coordination Drawings: Submit one reproducible transparency and three opaque reproductions.
 - 2. Product Data: Submit the number of copies which the contractor requires, plus those which will be retained by the Architect/Engineer.

- C. Accompany submittals with transmittal letter, in duplicate, containing:
 - 1. Date
 - 2. Project title and number
 - 3. Contractor's name and address
 - 4. The number of each Shop Drawing, Project Datum and Sample submitted
 - 5. Other pertinent data
- D. Submittals shall include:
 - 1. The date of submission
 - 2. The project title and number
 - 3. Contract Identification
 - 4. The names of:
 - a. Contractor
 - b. Subcontractor
 - c. Supplier
 - d. Manufacturer
 - 5. Identification of the product
 - 6. Field dimensions, clearly identified as such
 - 7. Relation to adjacent or critical features of the work or materials
 - 8. Applicable standards, such as ASTM or federal specifications numbers
 - 9. Identification of deviations from contract documents
 - 10. Suitable blank space for General Contractor and Architect/Engineer stamps
 - 11. Contractor's signed and dated Stamp of Approval
- E. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
 - 1. Finishes which involve Architect/Engineer selection of colors, textures or patterns
 - 2. Associated items which require correlation for efficient function or for installation

1.8 SUBMITTAL SPECIFICATION INFORMATION

- A. Every submittal document shall bear the following information as used in the project manual:
 - 1. The related specification section number
 - 2. The exact specification section title
- B. Submittals delivered to the Architect/Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.9 RESUBMISSION REQUIREMENTS

- A. Make re-submittals under procedures specified for initial submittals.
 - 1. Indicate that the document or sample is a re-submittal
 - 2. Identify changes made since previous submittals
- B. Indicate any changes which have been made, other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

- A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
- B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect/Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

- C. Do not deliver any submittals to the Architect/Engineer that do not bear the Contractor's stamp of approval and signature.
- D. Submittals delivered to the Architect/Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.11 ARCHITECT/ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

- A. The Architect/Engineer will:
 - 1. Review identified submittals with reasonable promptness and in accordance with schedule
 - 2. Affix stamp and initials or signature, and indicate requirements for re-submittal or approval of submittal
 - 3. Return submittals to Contractor for distribution or for resubmission
- B. Review and approval of submittals will not extend to design data reflected in submittals which is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.
- C. Architect/Engineer's review and approval is only for conformance with the design concept of the project and for compliance with the information given in the contract.
 - 1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
 - 2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.
- D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

- A. Do not make requests for substitution employing the procedures of this Section.
- B. The procedure for making a formal request for substitution is specified in Div. 1.

PART 2 - PRODUCTS - NOT USED.

PART 3 - EXECUTION - NOT USED

END OF SECTION

**SECTION 22 0513
ELECTRICAL PROVISIONS OF PLUMBING WORK**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Electrical provisions to be provided as plumbing work are indicated in other Division 22 sections, on drawings, and as specified.
- B. Types of work, normally recognized as electrical but provided as plumbing, specified or partially specified in this Section, include but are not necessarily limited to the following:
 - 1. Motors for plumbing equipment.
 - 2. Starters for motors of plumbing equipment, but only where specifically indicated to be furnished integrally with equipment.
 - 3. Wiring from motors to disconnect switches or junction boxes for motors of plumbing equipment, but only where specifically indicated to be furnished integrally with equipment.
 - 4. Wiring of field-mounted float control switches, flow control switches, and similar plumbing-electrical devices provided for plumbing systems, to equipment control panels.
 - 5. Pipe heat tracing.
- C. Refer to Division 22 sections for specific individual plumbing equipment electrical requirements.
- D. Refer to Division 26 sections for motor starters and controls not furnished integrally with plumbing equipment.
- E. Refer to Division 26 sections for junction boxes and disconnect switches required for motors and other electrical units of plumbing equipment.

1.2 RELATED WORK

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to work of this Section.

1.3 QUALITY ASSURANCE

- A. Wherever possible, match elements of electrical provisions of plumbing work with similar elements of electrical work specified in Division 26 sections for electrical work not otherwise specified.
- B. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.4 SUBMITTALS

- A. Include in listing of motors, voltage, notation of whether motor starter is furnished or installed integrally with motor or equipment containing motors.

PART 2 - PRODUCTS

2.1 MOTORS

- A. Provide motors for plumbing equipment manufactured by one of the following:
 - 1. Baldor Electric Company.
 - 2. Century Electric Div., Inc.
 - 3. General Electric Co.
 - 4. Louis Allis Div.; Litton Industrial Products, Inc.
 - 5. Lincoln Electric
 - 6. Marathon Electric Mfg. Corp.
 - 7. Reliance Electric Co.
 - 8. Westinghouse Electric Corp.

- B. Motor Characteristics. Except where more stringent requirements are indicated, and except where required items of plumbing equipment cannot be obtained with fully complying motors, comply with the following requirements for motors of plumbing work:
- C. Temperature Rating. Rated for 40°C environment with maximum 50°C temperature rise for continuous duty at full load (Class A Insulation).
- D. Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than 5 starts per hour for manually controlled motors.
- E. Phases and Current Characteristics. Provide squirrel-cage induction polyphase motors for 3/4hp and larger, and provide capacitor-start single-phase motors for 1/2hp and smaller, except 1/6hp and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division 26 sections, and with individual equipment requirements specified in other Division 22 requirements. For 2-speed motors provide 2 separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.
- F. Service Factor. 1.15 for polyphase motors and 1.35 for single-phase motors.
- G. Motor Construction. Provide general purpose, continuous duty motors, Design "B" except "C" where required for high starting torque.
 - 1. Frames. NEMA #56.
 - 2. Bearings are to be ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual section of Division 22 for fractional-hp light-duty motors where sleeve-type bearings are permitted.
 - 3. Except as indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded drip-proof motors where exposed to contact by employees or building occupants. Provide weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division 22 for other enclosure requirements.
 - 4. Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
 - 5. Noise Rating: Provide "Quiet" rating on motors.
- H. All motors shall be premium efficiency.

2.2 EQUIPMENT FABRICATION

- A. Fabricate plumbing equipment for secure mounting of motors and other electrical items included in work. Provide either permanent alignment of motors with equipment, or adjustable mountings as applicable for belt drives, gear drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives. Arrange for lubrication and similar running-maintenance without removal of guards.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, anchored to resist torque, drive thrusts, and other external forces inherent in plumbing work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.
- B. Verify voltage with Electrical Plans.

END OF SECTION

**SECTION 22 0514
PLUMBING ALTERATIONS PROJECT PROCEDURES**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Inspect and service existing equipment and materials that are to remain or to be reused.
- B. Disposal of equipment, materials, or housekeeping pads to be abandoned. Prior to disposal, the Contractor shall verify with the Owner what is to be salvaged by the Owner and what is to become the property of the Contractor.
- C. Handling of equipment and materials to be removed.

1.2 QUALITY ASSURANCE

- A. Coordination with the Owner prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.3 CONTRACT DRAWINGS

- A. There is the possibility that existing conditions and devices are affected by the work indicated on the drawings and called for in the specifications (project manual) that do not appear on the drawings. It is the Contractor's responsibility to visit the site and determine all of the existing conditions and to consider these existing conditions when making and presenting a proposal, to have a complete proposal.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Material used to upgrade and repair existing equipment shall conform to that specified.
- B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.
- C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer's approved distribution channels, shall have manufacturer's warranties for the new material being used, and shall be listed for the use intended.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Contractor shall notify the Architect/Engineer, in writing, accordingly.
- B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect/Engineer, in writing.
- C. Verify field measurements, above and underground piping connections and flows.
- D. Demolition Drawings are based on casual field observation, and when available, existing record documents. Report discrepancies to Architect before disturbing existing installation, and immediately after such discrepancies are discovered.
- E. Field verify existing conditions and actual utility uses prior to final connections. Existing drawings may not have been available for all required information. Use pipe inspection camera system to field verify existing sanitary / grease waste connections. Verify flow direction and depth prior to connection to existing plumbing systems.

3.2 APPLICATION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be cleaned and reconditioned, including cleaning of piping systems prior to installation and reuse.
- B. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and be removed from the site.
- C. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner or the Architect / Engineer. Relocate material and / or equipment as directed by Owner.
- D. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.
- E. Materials, equipment and housekeeping pads not to be reused or reconnected shall be removed for Owner's review and salvaged by Contractor.
- F. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner's use.
- G. Clean and repair existing materials and equipment that remain or are to be reused.
- H. Contractor shall utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

3.3 SEQUENCE AND SCHEDULE

- A. Coordinate utility service outages with Utility Company, Architect and Owner.
- B. Provide additional or temporary valves, piping and connections to maintain existing systems in service during construction.
- C. Existing Plumbing Service: Refer to drawings for work in remodeled areas. Where facilities in these areas are to remain in service, any related work to keep the facilities in operation is specified in this Division. Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Maintain acceptable temperature and humidity control within existing building during renovation activities.
- D. Remove and replace existing Plumbing systems and appurtenances as occasioned by new or remodeled construction. Re-establish service that may be interrupted by remodeled construction.
- E. Refer to other drawings series for work in remodeled areas. Where facilities in these areas are required to remain in service, any related work required to keep these facilities in operation is specified in this Division.
- F. Remove and replace existing piping coincident with the construction.
- G. Remove or relocate existing piping or housekeeping pads as occasioned by new or remodeled construction. Cap unused domestic piping beyond the new finish line.
- H. Relocate all domestic piping as required to accommodate new work requiring precedence.
- I. Remove concrete housekeeping pad where materials or equipment have been removed.
- J. Remove all known utilities that do not provide service to the buildings that remain.
- K. Remove existing plumbing vent penetrations through roof not to be reused. During demolition, abandoned plumbing vents are to be removed in their entirety. Do not cap the vent pipes below the roof deck and abandon in place. The hole in the roof is to be patched and made water tight.

3.4 DEMOLITION AND EXTENSION OF EXISTING PLUMBING WORK

- A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such

destination as directed by the Owner's representative unless they are not wanted, then it will be the responsibility of this Contractor to remove such items and properly dispose of them. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion, and upon approval of the Owner's representative substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

- B. All items to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean, repair, and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore them to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.
- C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner's representative to such items and receive further instructions before removal. Items damaged in repositioning operations are the contractor's responsibility and shall be repaired or replaced by the contractor as approved by the owner's representative, at no additional cost to the Owner.
- D. Plumbing, piping and appurtenances to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner's representative. Piping not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Construction Inspector. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities that must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner's representative hereinbefore specified.
- E. Repair adjacent construction and finishes damaged during demolition and extension work.
- F. Maintain access to mechanical installations that remain active. Modify installation or provide access panel as appropriate.
- G. Extend existing installations using materials and methods compatible with existing plumbing installations, or as specified.
- H. Existing plumbing piping and devices found to need additional hangers installed should be added at no additional cost to the Owner.

3.5 PROTECTION OF THE WORK

- A. Provide adequate temporary support and auxiliary structure as necessary to ensure structural value or integrity of affected portion of work.
- B. Provide devices and methods to protect other portions of work from damage.
- C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

3.6 IDENTIFICATION OF EQUIPMENT IN RENOVATED AREAS

- A. Identification of Equipment: Provide new identification of all existing equipment to be reused and located within the renovated areas. Do not include the description "existing". Provide new nameplates for all existing plumbing equipment in renovated areas as specified in Section 22 05 00 Plumbing General Provisions.

END OF SECTION

**SECTION 22 0515
PLUMBING EARTHWORK**

PART 1 - GENERAL

- A. Excavate and backfill for pipe trenches for underground piping, and excavate for structures installed as part of plumbing work.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Excavate trenches for underground piping to the required depth to ensure 2 foot minimum coverage over piping.
- B. Cut the bottom of the trench or excavation to uniform grade.
- C. Should rock be encountered, excavate 6 inches below grade, fill with bedding material and tamp well.
- D. Lay out alignment of pipe trenches to avoid obstructions. Assure that proposed route of pipe will not interfere with building foundation before any cutting is begun. Should interference be found, contact the Architect/Engineer before proceeding.

3.2 BACKFILL

- A. Backfill shall not be placed until the work has been inspected, tested and approved. Complete backfill to the surface of natural ground or to the lines and grades shown on drawings. Except where special materials are requested, use suitable friable soils from other excavation as backfill material. Do not use peat, silt, muck, debris or other organic materials. Deposit backfill in uniform layers and compact each layer as specified in Division 2.
- B. Compacting Backfill. Place material in uniform layers of prescribed maximum thickness and wet or dry the material to optimum moisture content. Compact with power-driven tampers to the prescribed density. Place regular backfill in 8 inch maximum layers, loose measure. Compact to not less than 95% of maximum soil density as determined by ASTM D-698 Standard Proctor.
- C. Restoration. Compact backfill, where trenching or excavation is required in improved areas such as pavements, walks, and similar areas, to a condition equal to the adjacent undisturbed earth, and restore surface of the area to the condition existing prior to trenching or excavating operation.

3.3 DISPOSAL OF EXCESS MATERIAL

- A. Remove excess excavation material or material unsuitable for backfill. Excess material can be spread on grade, or shall be removed from site as directed by the Owner / Architect.

END OF SECTION

SECTION 22 0516
EXCAVATING, BACKFILLING AND COMPACTING FOR UTILITIES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 apply to this section.
- B. Refer to Instructions to Bidders for substitution of materials and products.
- C. Addenda issued during the bidding period that affect this section of the specifications.

1.2 WORK INCLUDED

- A. Coordinating all excavating and backfilling for the underground storm sewer, sanitary sewer, water distribution lines, and all related appurtenances.
- B. The extent of lines, excavation, and backfill shall be in conformance with the locations, lines, elevations and grades shown on the drawings prepared by the MEP Engineer.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. Earthwork
- B. Water Distribution
- C. Sanitary Sewer
- D. Plumbing

1.4 REFERENCES

- A. American Society for Testing and Materials (ASTM) Use current edition.
 - 1. ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³)
 - 2. ASTM D1556, Standard Test method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
 - 3. ASTM D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
 - 4. ASTM D4254, Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
- B. City Standards
- C. Local Governing Agencies
- D. Texas Health and Safety Code, Chapter 161, Subchapter Q, as amended by House Bill No. 1927.

1.5 WARRANTY

- A. Provide written warranty against defects in the material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion of the Project. Refer to Division 1 for Warranty form.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Sand: Clean, local sand
- B. Earth Backfill: Clean local material consistent with the surrounding earth material and free of large clods, roots, rocks or other debris.

PART 3 – EXECUTION

3.1 EXCAVATION

- A. General:
 - 1. All utility trenches shall be constructed in conformance with OSHA trench safety standards.

2. Sheeting and shoring shall be accomplished to the extent necessary to maintain the sides of the trench in a vertical position throughout the construction period for trenches five feet in depth or deeper. Where approved, trench sides may be laid back in lieu of shoring to meet OSHA safety standards.
 3. Utilities shall not be constructed or laid in a trench in the presence of water. All water shall be sufficiently removed from the trench prior to the line placing operation to ensure a dry, firm bed on which to place the utility line.
- B. Storm and Sanitary Sewer Trenches:
1. For pipe sizes less than 42 inches in diameter, the minimum trench width shall be outside diameter of pipe plus 18 inches.
 2. Trenches shall be excavated to a depth of at least 6 inches below the barrel of pipe.
- C. Appurtenances:
1. Any overdepth excavation below appurtenances shall be refilled with compacted select fill or bank sand.
- D. Water Line Trenches:
1. Water lines shall be at least two feet in depth from the top of proposed grade to the top of pipe.
 2. Trench width for water lines shall be a minimum of the outside pipe diameter plus 18 inches.
 3. Trenches shall be excavated to a depth of at least 6 inches below the barrel of pipe.

3.2 PIPE BEDDING AND BACKFILL – BELOW BUILDING SLAB

- A. Storm and Sanitary Sewer Trenches:
1. Bedding, sewer pipe, and initial backfill over the pipe must be placed in a single day for any given portion of pipe. Initial backfill consisting of bank sand or select backfill shall be placed to one foot above the top of pipe for standard earth backfill.
 2. Remainder of trench backfill shall be placed the next day or later in 8 inch lifts.
 3. Backfill shall be placed in uniform layers not to exceed 8 inches loose measured depth, and compacted to a minimum of 95% of Standard Maximum Density (ASTM D698).
- B. Water Line Trenches Below Building Slab/Outside Building Slab:
1. Pipe bedding shall consist of 6 inches of clean sand placed before the pipe is laid.
 2. After laying pipe and ensuring that the pipe is properly placed and supported by the sand bedding, clean sand backfill shall be placed to 6 inches above the top of pipe. The sand backfill shall be thoroughly rodded and tamped for compaction.
 3. For water lines to be beneath the building and pavement and to one foot from the outer edge of pavement, the remainder of the trench backfill shall be clean sand placed in 6 inch lifts and compacted to 95% Standard Proctor.
 4. For water lines not beneath the building and pavement or within one foot from the outer edge of pavement the remainder of the trench backfill shall be earth fill placed in uniform layers not to exceed 8" loose depth. Each lift shall be compacted to a minimum of 90% of Standard Density (ASTM D698) at the proper moisture content specified in the soils report for this project. All earth backfill shall be placed the next day or later after the pipe is laid.
 5. Backfill, under pavement and to one foot from outer edge, up to one foot below subgrade elevation. Remainder of backfill to subgrade to be as specified in paragraph 4 above.

3.3 PIPE BEDDING AND BACKFILL – OUTSIDE BUILDING SLAB

- A. Storm and Sanitary Sewer Trenches:
1. Bedding, sewer pipe, and initial backfill over the pipe must be placed in a single day for any given portion of pipe. Initial backfill consisting of bank sand or select backfill shall be placed to one foot above the top of pipe for standard earth backfill.
 2. Remainder of trench backfill shall be placed the next day or later in 8 inch lifts.
 3. Backfill shall be placed in uniform layers not to exceed 8 inches loose measured depth, and compacted to a minimum of 95% of Standard Maximum Density (ASTM D698).
 4. Backfill, under pavement and to one foot from outer edge, up to one foot below subgrade elevation. Remainder of backfill to subgrade to be as specified in paragraph 3 above.

3.4 NATURAL GAS PIPING

- A. Natural Gas Trenches:
1. Natural gas lines shall not be installed under slabs on grade unless pipes are sleeved and vented as per Section 22 63 11.
 2. Natural gas lines shall not be installed in trenches with other utilities.
- B. Utility Locators:
1. Provide metallic locator over all non-metallic gas piping utilities. Locator tape shall be a maximum of 12 inches below grade and centered over the utility(s).

END OF SECTION

**SECTION 22 0517
PLUMBING ACCESS DOORS**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install access doors in wall or ceiling locations as required or shown for access to valves, controls, regulating devices, water arresters and other equipment requiring maintenance, adjustment or operation.

PART 2 - PRODUCTS

2.1 NON-FIRE RATED ACCESS DOORS

- A. 16-Gauge frames
- B. 14-gauge steel panels
- C. Continuous fully concealed hinges
- D. Flush screwdriver cam lock for Owner selection
- E. Prime coat finish
- F. Brushed satin stainless steel finish for restroom, kitchen or cafeteria installation
- G. Material suitable for wall and/or ceiling mounting

2.2 FIRE RATED ACCESS DOORS

- A. UL listed, 1-1/2 hour Label "B", access doors
- B. 16-Gauge stainless steel
- C. 20-Gauge insulated sandwich-type door panel.
- D. Two inch thick with fire rated insulation
- E. Continuous fully concealed hinge
- F. Automatic closing and latching mechanism
- G. Knurled knob and recessed key operation for Owner selection
- H. Interior latch release slide for opening from inside
- I. Prime coat finish
- J. Material suitable for wall and/or ceiling mounting

2.3 ACCEPTABLE MANUFACTURERS

- A. Milcor
- B. MIFAB
- C. Acudor
- D. Elmdor

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Access doors specified in Division 22 will be installed by other crafts. Not all required access doors are shown. Coordinate with the Contractor to locate access doors for ease of operation and maintenance of concealed equipment.
- B. Installation shall be in accordance with the manufacturer's printed instructions.
- C. Minimum size required:
 - 1. 24" x 24" for plumbing multiple isolation valves and electrical related items in ceilings
 - 2. 8"x8" for plumbing for single isolation valve or shock arrestor

END OF SECTION

**SECTION 22 0519
PRESSURE AND TEMPERATURE INSTRUMENTS**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This section specifies gauges, thermometers, wells and/or pressure and temperature test stations to be installed as specified.

1.2 RELATED WORK

- A. Division 22, Plumbing
 - 1. Plumbing General Provisions
 - 2. Pipe and Pipe Fittings, General
 - 3. Valves, Strainers and Vents

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - GAUGES AND THERMOMETERS

- A. Terice
- B. Taylor
- C. Marsh
- D. Weksler
- E. Marshalltown
- F. Weiss
- G. Miljoco

2.2 PRESSURE GAUGES

- A. Case and Ring: 4" type 304 stainless steel; liquid filled case with stainless steel bayonet ring.
- B. Dial: White aluminum with black markings
- C. Window: Clear acrylic
- D. Tube: Phosphor bronze and forged brass socket.
- E. Gauge accuracy: +/- 1% over operating range.
- F. For pulsating service, provide impulse dampers.
- G. Without flange for pipe mounting.
- H. With flange for wall mounting.
- I. Weiss Model: Domestic Water 4CTSLF (Lead Free) 0-100 PSI

2.3 THERMOMETER WELLS

- A. Brass or type 300 stainless steel. Machined bar stock, 1-piece construction (Lead Free).
- B. Where installed in insulated piping or vessels, provide with extension neck to match insulation thickness.
- C. Provide metal-to-metal contact with bulb chamber for maximum sensitivity.
- D. Wells shall be sized to extend a minimum of 50% into pipe.

2.4 THERMOMETERS IN PIPING SYSTEMS OR VESSELS

- A. Die cast aluminum case with baked epoxy finish.
- B. Adjustable angle 9" scale length.
- C. Clear acrylic window.
- D. Brass stem, length to match well.
- E. Red reading organic spirit filled-in magnifying glass column.
- F. White background with black figures and markings.
- G. Brass stems and union connections (Lead Free).
- H. Accuracy: +/- 1% of scale range.
- I. Range:
 - 1. Hot water lines: 30°F to 240°F.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with drawing details and manufacturer's recommendations.
- B. Provide a ball valve at each gauge (Lead Free).
- C. Locate gauges and thermometers to be easily readable from the floor at a 5'-6" eye level. Use adjustable angle or rigid stem as required. Install gauges in upright position.
- D. Install gauges in the following locations: across pumps, storage tanks, heat exchangers.
- E. Install thermometer in the following locations: At storage tanks, across heat exchangers, across boiler, leaving side of water heater, leaving water side of tempered water valves, and hot water supply and return lines.
 - 1. Hot water lines: 30°F to 240°F.
 - 2. Tempered water valves 0°F to 120°F.

END OF SECTION

**SECTION 22 0523
VALVES, STRAINERS AND VENTS**

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Plumbing Valves
- B. Pipe strainer and suction diffusers.

PART 2 - PRODUCTS

2.1 VALVES

- A. Pressure Ratings:
 - 1. Unless otherwise indicated, use valves suitable for 125 minimum psig working steam pressure (WSP) and 450°F.
 - 2. The pressure temperature rating of valves shall be not less than the design criteria applicable to components of the system.
 - 3. Use grooved butterfly valves when using grooved piping.
- B. Butterfly Valves
 - 1. Butterfly valves shall conform to MSS-SP67.
 - 2. Valves shall have a full lug type body designed for installation between ANSI standard flanges, and shall be rated at full working pressure with downstream flange removed.
 - 3. All valves for domestic use must be lead free.
 - 4. Do not use Victaulic flanges on butterfly valves.
 - 5. All butterfly valves shall have a stainless steel disc.
- C. Ball Valves
 - 1. Provide ball valves with:
 - a. Blowout proof stem.
 - b. Full size port, 316 stainless steel ball and stem.
 - c. Cast bronze body.
 - d. Threaded ends.
 - 2. Seat, seals, thrust washers and packing shall be suitable for the intended service.
 - 3. Service rating:
 - a. 150 psi saturated steam.
 - b. 600 psi WOG.
 - 4. Provide with memory stop for balancing valves.
 - 5. Where Viega ProPress fittings are used, Viega ProPress ball valves may be used, or as approved.
 - 6. All valves for domestic use must be lead free.
 - 7. Do not use PVC or CPVC ball valves.
- D. Valve Connections
 - 1. Provide valves suitable to connect to adjoining piping as specified for pipe joints. Use pipe size valves. Sweated joints are not allowed.
 - 2. Thread pipe sizes 2" and smaller.
 - 3. Flange pipe sizes 2-1/2" and larger.
 - 4. Use screw to solder adapters for copper tubing.
 - 5. Use grooved body valves with mechanical grooved jointed piping.
 - 6. Use press valves when using copper press systems.
- E. Valve Operators
 - 1. Provide suitable hand-wheels for gate, globe, angle or drain valves and inside hose bibbs.
 - 2. When cocks and valves are furnished with square head stem:
 - a. Provide one wrench for every ten cocks or valves sized 2" and smaller,

- minimum of two.
 - b. Provide each cock or valve size 2-1/2" and larger with a wrench with setscrew.
 - 3. Where butterfly valves are provided:
 - a. Provide gear operators on valves 6" and larger.
 - b. Where valves are located 7' or more above the finished floor in equipment room areas provide chain-operated sheaves. Extend chains to about 5' above floor and hook to clips, arrange to clear walking space.
 - c. Lever lock handle with toothed plate for shut-off service and infinitely adjustable handle with lock and nut and memory stop for throttling service on valves 4" and smaller.
 - d. All butterfly valves shall have a stainless steel disc.
- F. Acceptable Manufacturers (All listed must be lead free);
 - 1. Stockham
 - 2. Dezurik
 - 3. Crane
 - 4. Nibco
 - 5. Keystone
 - 6. Jenkins
 - 7. Kitz
 - 8. Apollo
 - 9. Milwaukee Valve
 - 10. Hammond
- G. Check Valves:
 - 1. Bronze body, 2" and smaller, bronze disc (Teflon disc for steam service), regrinding swing check, screw-in cap, threaded connection.
 - 2. Iron body, 2-1/2" and larger, bronze trim, non-slam: stainless steel pins and springs, and bronze plate or bronze mounted, regrind-renew check, bronze seat ring and disc. Provide either wafer or threaded lug.
 - 3. Acceptable Manufacturers (All listed must be lead free):
 - a. Mission Duocheck
 - b. Nibco
 - c. Keystone
 - d. Kitz
 - e. Apollo
- H. Backflow Preventer (All valves for domestic use must be lead free):
 - 1. BFP-1 (2" and smaller) bronze body, reduced pressure zone type with two inline independent check valves with an intermediate relief valve, complete with two full port ball valve shut-offs and ball type test cocks. Bronze strainer on inlet. Provide air gap fitting with full size drain piped to nearest floor drain. Watts 909-QT-S-LF.
 - 2. BFP-2 (2-1/2" and larger) stainless steel reduced pressure zone type with two inline independent check valves with reverse relief valves, two non-rising stem resilient sealed gate valves, cast iron strainer on inlet. Provide air gap fitting piped full size to nearest floor drain. Apollo RP4ALF-YS.
- I. Provide valves of same manufacturer throughout where possible.
- J. Provide valves with manufacturer's name and manufacturing location, duty and pressure rating clearly marked on outside of body.
- K. Where valves are installed in insulated piping, provide with extended neck so valve operator and stop plate clears the full thickness insulation.
- L. Provide valve, seat and trim materials suitable for the intended service.

2.2 PIPE SYSTEMS STRAINERS

- A. Body:
 - 1. Bronze "Y" pattern or basket as shown on the drawings.
 - 2. Line size.
 - 3. Threaded strainer blow down port.
 - 4. ASTM A #126 Class B Cast Iron Body.
- B. Construction:
 - 1. 2" size and smaller with screw connections rated 400 psi WOG.
 - 2. Over 2" size with flanged connections, rated 125 psi WOG.
- C. Fabricate screens of Monel or type 304 stainless steel:
 - 1. With 20 mesh woven wire in piping systems through 2".
 - 2. With 0.045 perforations in piping systems 2-1/2" and 3".
 - 3. With 0.125 perforations in piping systems 4" and larger.
- D. Start-up:
 - 1. Provide an additional fine mesh disposable screen for use during start-up operations.
 - 2. Remove after 30 days.
 - 3. Attach to piping for Owner's review.
- E. Acceptable Manufacturers (All listed must be lead free):
 - 1. Apollo
 - 2. Crane
 - 3. Keckley
 - 4. Kitz
 - 5. McAlear
 - 6. Mueller
 - 7. Muesco
 - 8. Nibco
 - 9. Zurn

2.3 VALVE SCHEDULE

- A. Domestic Service
 - 1. Cold and Hot water service (all listed must be Lead Free):
 - a. Nibco Ball Valve full port through 2": T-585-66-LF
 - b. Nibco Butterfly Valve 2-1/2" and larger: LD-2000 EDPM Gaskets
 - c. Watts Ball Valve 4" and larger: G-4000-FDA
 - d. Viega ProPress Bronze Ball Valves (where Viega ProPress fittings are used)
 - e. Kitz Full Port through 2" - #868M Lead Free
 - f. Milwaukee Full Port 1/4"-2" #8303A
 - g. Milwaukee Standard Port 2-1/2" & 3" #8503
 - h. Apollo Full Port to 3-1/2" 77CALF
 - i. Apollo Conventional Port 2-1/2"=3" 7OLF
 - 2. Check Valve (All listed must be Lead Free):
 - a. Nibco Check Valve: T - 413 – Y -LF (Teflon Seats)
 - b. Nibco Check Valve 2-1/2" and larger: F - 918 – Y -LF (Buna-N Disc)
 - c. Nibco Check Valve 2-1/2" and larger: W - 920 -W-LF (Wafer)
 - d. Kitz Y & Check: A-22T
 - e. Kitz 2-1/2" and Larger #778 C.I.
 - f. Kitz Wafer Check 2-1/2" and Larger #7032
 - g. Apollo Check Valve 163 TLF
 - h. Apollo Check Valve 2-1/2" – Larger 910 FLF

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install valves with stems upright or horizontal, not inverted.
- B. Install valves for shut-off and isolating service at each piece of equipment, at vertical risers, and where shown on the drawings.
- C. Use butterfly valves and ball valves in domestic hot water and domestic cold water systems interchangeable in place of gate and globe valves.
- D. Use butterfly valves and ball valves in circulating water systems, for balancing duty.
- E. Provide drain valves at main shut-off valves and low points of piping and apparatus so the systems can be entirely drained.
 - 1. 1" valve for pipes 6" and larger.
 - 2. 3/4" valve for pipes smaller than 6".
 - 3. Terminate with pipe plug.
 - 4. Drain valves shall be ball valves.
- F. Provide isolation valves in domestic water lines to isolate all equipment, restrooms, hose bibbs, and where shown on the drawings.
- G. Where valves are installed in insulated pipe, valve operator shall have an insert so the lever or handle will not damage the insulation. Install handles so the lever or handles will not damage the insulation.
- H. Provide clearance for installation of insulation and access to valves.
- I. Provide access where valves are not exposed.

3.2 VALVE TAGS

- A. Furnish valves with 1-1/2" diameter brass valve tags with stamped, black or red-filled numbers. Service designations shall be 1/4" letters, and valve numbers shall be 2" letters. Engineer shall approve Service designations. Secure tags to valves by use of brass "S" hooks or brass chain. Secure chain to valve by use of copper or Monel meter seals. Valve tags are not required if the valve is located within 3' of the equipment being served and the service is obvious.
- B. Mount charts and drawings listing functions of each valve and its location in a metal and glass frame. Place charts and drawings as directed; in addition, on the record drawings mark the symbols and furnish a valve schedule properly identifying the valve number, service, exact location, the material being piped, and the room number of area that the valve services. This schedule shall be furnished on reproducible drafting paper or film suitable for reproduction on an Ozalid machine. The Owner shall approve the size of drafting paper. Provide a copy of the valve chart in the Operating and Maintenance Manuals.

3.3 PIPE SYSTEMS STRAINERS

- A. Provide strainers in supply piping to circulating pumps, thermostatic mixing valves, before solenoid valves and trap primer valves.

END OF SECTION

**SECTION 22 0719
PLUMBING PIPING INSULATION**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install piping insulation, jackets, accessories and covering of specified materials. The insulation shall be used for high and low temperature piping applications including domestic hot and cold water, roof and overflow drain sump bodies and rain leaders, horizontal sanitary drain piping which receives condensate, make-up water and pool heating water.

1.2 QUALITY ASSURANCE

- A. The intent of insulation specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.
- B. An approved contractor for this work under this Division shall be:
1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their owners satisfactorily for not less than 3 years.
- C. All piping insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50, as determined by test procedures ASTM E 84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.
- D. Condensation on any insulated piping system is not acceptable.
- E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also repair any damage caused by the condensation.
- F. Where existing insulated piping, or other surfaces are tapped, remove existing insulation back to undamaged sections for hot surfaces or to nearest insulation stop for cold surfaces, and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.3 APPROVALS

- A. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in Division 1 General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location and the manufacturer's installation instructions for each product.
- B. Make a field application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Glass fiber pipe insulation:
1. Johns-Manville Micro-Lok AP-T
 2. Owens-Corning ASJ/SSL
 3. Knauf ASJ/SSL

- B. Cellular Glass Insulation (Foamglass):
 - 1. Pittsburg Corning
 - 2. Cell-U-Foam
- C. Aluminum Jacketing:
 - 1. Childers
 - 2. Pabco
 - 3. RPR
- D. Fiberglass reinforcing cloth mesh:
 - 1. Perma Glass Mesh
 - 2. Alpha Glass Mesh
 - 3. Childers Chil-Glas
 - 4. Vimasco
- E. Mastics and Adhesives
 - 1. Childers
 - 2. Foster
 - 3. Vimasco
 - 4. Armstrong 520 Adhesive
- F. Elastomeric Insulation
 - 1. Armacell
- G. Weather Resistant Coating
 - 1. WB Armaflex Finish
- H. Glass fiber blanket insulation
 - 1. Manville R-series Microlite FSKL
 - 2. Owens-Corning eD75 or ED100 RKF
 - 3. Knauf 0.75 PCF FSK

2.2 FIBERGLASS PIPE INSULATION

- A. Heavy density, dual temperature fiberglass insulation with factory applied, all service, reinforced vapor barrier jacket having integral laminated vapor barrier. Provide with a factory applied pressure sensitive tape closure system and matching butt strips. Supply in thickness as shown.
 - 1. Thermal conductivity 0.23 @ 75°F mean (ASTM 335).

2.3 ELASTOMERIC INSULATION

- A. Insulation material shall be flexible, closed-cell elastomeric insulation in tubular or sheet form. Material shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84, latest revision. Sheet material with a thickness greater than 3/4" shall have a flame spread rating of 25 or less and a smoke developed rating of 100 or less when tested in accordance with ASTM E84, latest revision. In addition, the product, when tested, shall not melt or drip flaming particles, and the flame shall not be progressive. In addition, all materials shall pass simulated end-use fire test. Minimum 3/4" thick.
 - 1. Thermal conductivity 0.27 at 75°F mean (ASTM C177 or C518)

2.4 CELLULAR GLASS INSULATION

- A. ASTM C552:
 - 1. "k" value of 0.35 @ 75°F ("ksi" value of 0.047 @ 24°C);
 - 2. 8.0 lb/cu.ft. (128 kg/cu.m.) density

2.5 INSULATION/SHIELD AT HANGERS

- A. Field fabricated: Use 360° sections of rigid foamglass insulation that will support the bearing area at hangers and supports. Further support insulation at hangers and supports with a shield of galvanized metal covering at least half of the pipe circumference, and conforming to

the schedule. Insulation shall extend at least 1" beyond metal shield on each end. When pipe is guided at top and bottom, metal shields shall cover the whole pipe circumference. Adhere metal shield to insulation so that metal will not slide with respect to insulation with ½" aluminum bands (2) per shield.

1. Sections of foam glass insulation may be used of the same outside diameter of the adjoining pipe insulation.
 2. Minimum thickness of foam glass insulation shall not be less than 1" thick.
- B. Pipe saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter or more than 22". Provide 18 gauge through 4" pipe and 16-gauge 5" pipe and above.

2.6 SEALANT, ADHESIVE AND FINISH

- A. Lap Adhesive. Provide Childers CP-82 adhesive.
- B. Vapor Barrier Finish:
 1. Indoors: Provide as insulation coating Childers CP-35, white.
 2. Outdoors: Provide as insulation coating Childers Encacel X.
 3. Underground: Provide Childers CP-22/24 for fittings and areas. Pittwrap cannot be used.
- C. Sealant. Provide Childers CP-76 vapor barrier sealant.
- D. Lagging Adhesive. Provide Childers CP-50.
- E. Other products of equal quality will be acceptable only upon approval.

2.7 ALUMINUM JACKETING

- A. Finish insulated piping outdoors with a smooth prefabricated Z-lock aluminum jacket 0.016" thick with factory applied 1 mil polyethylene/40 lb and Fab strap. Kraft moisture barrier. Childers Lock-On or approved equal.
- B. Valves, Fittings and Flanges. For finishing valves, fittings, flanges and similar installations, provide formed aluminum covers, 0.024" thick.
- C. Straps and Seals. Provide ½" x 0.020 stainless steel strapping and seals for jackets and covers according to manufacturer's recommendations.

2.8 GLASS FIBER BLANKET INSULATION

- A. Minimum density of 1.0 PCF, 2" thick, installed R value to be 6.0 or better at 75°F mean, facing of 0.35 mil foil reinforced with glass yarn mesh and laminated to 40 lbs fire resistant kraft.

PART 3 - EXECUTION

3.1 INTERIOR PIPING

- A. Cover all piping with glass fiber, heavy density, dual temperature pipe insulation with a vapor barrier jacket. Apply insulation to clean, dry pipes. Longitudinal seams shall be joined firmly together and sealed with self-sealing lap joints. Butt insulation joints firmly together and seal with a 3" wide ASJ butt strip seal. Longitudinal seams and butt strip laps shall be coated and sealed with CP-35 vapor barrier coating for chilled water piping applications.
- B. Install hanger with protective shield, on the outside of all insulation.
- C. Where domestic water pipes (1/2" & ¾" pipe sizes) are installed on trapeze type hangers, provide galvanized sheet metal protection shields at these locations. Place insulation jacket directly on hanger. Incompressible, load bearing insulation segments are not required.
- D. Pipe Saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter. Provide 18-gauge through 4" pipe and 16-gauge for 5" pipe and above.

- E. Seal ends of pipe for drinking chilled water insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the glass, down onto the pipe making a complete seal.
- F. Apply a smooth flood coat of white lagging Foster 8142W over all exposed insulation.
- G. Piping to be insulated as specified above:
 - 1. Domestic hot water and cold water (cold water piping is to be insulated in outside walls to 5' inside building, and in any location subject to freezing). Maintain insulation for domestic hot and cold water in Mechanical Rooms and Central Plant.
 - 2. Make-up water
 - 3. Horizontal sanitary drain piping that receives condensate
 - 4. Exposed to view storm drainage system including roof and overflow drain bodies, vertical piping from drain body to elbow, all horizontal rain leaders, and first elbow turning down

3.2 PIPING OUTDOORS ABOVE GRADE

- A. Insulate all water piping exterior of building above grade with rigid foam insulation and aluminum jacketing.
- B. Adhere the vapor barrier jacket longitudinal seam with vapor barrier adhesive.
- C. Cover all valves, fittings and flanges with factory made molded or field fabricated segments of pipe insulation of a thickness and material equal to the adjoining insulation. Adhere segments together with no voids, using CP-82 adhesive. Secure fitting insulation covers and segments in place with ½" wide glass filament tape.
- D. Apply a tack coat of fitting mastic over the insulation and tape.
- E. Neatly embed with 10 x 10 fiberglass cloth into the tack coat.
- F. Apply mastic over the fiberglass cloth to a thickness where the fabric is not visible after completion.
- G. Seal ends of pipe insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the foam, down onto the pipe, making a complete seal.
- H. Finish with aluminum jacketing as specified.

3.3 FLANGE, VALVE AND FITTING INSULATION

- A. Cover valves and flanges with fabricated segments, fittings with two-piece factory molded fittings, and both of matching pipe insulation type and thickness equal to that of the adjoining pipe. Fittings and fabricated segments shall be securely held in place.
 - 1. Apply a tack coat of insulating mastic to the insulated fitting to produce a smooth surface.
 - 2. After mastic is dry, apply a second coat of vapor barrier mastic. Neatly embed with 10 x 10 fiberglass cloth into the tack coat.
 - 3. Overlap mastic and fiberglass cloth by 2" on adjoining sections of pipe insulation.
 - 4. Apply a second coat of mastic over the fiberglass cloth to present a smooth surface.
 - 5. Apply mastic to a wet film thickness of 3/64".
 - 6. Fabric shall not be visible after completion.
 - 7. Vapor seal flanges, valves and fittings with Childers CP-35.
- B. PVC fitting covers are not acceptable.

3.4 ALUMINUM JACKETING (Insulated Piping Outdoors Above Grade)

- A. Apply smooth aluminum jacket on piping, valves, fittings and flange covers according to manufacturer's recommendations, using stainless steel strapping and seals, to provide weather tight covering and to shed water.
- B. Aluminum jacketing is not considered as contributing to the vapor barrier or the insulation jacket. The vapor barrier must be sufficient in itself for this function. Lap each adjoining

- jacket section a minimum of 3" to make a weather tight seal.
- C. Install straps on 9" centers and at each circumferential lap joint.
 - D. Cover and seal all exposed surfaces.
 - E. The use of screws and rivets is not approved.
 - F. Provide isolation (30# felt) between the aluminum jacket and the sheetmetal protection shield at each pipe support point.

3.5 CONCEALED STORM DRAIN PIPING

- A. Provide flexible glass fiber insulation with factory-applied, reinforced UL labeled Foil-Skrim-Kraft (FSK) facing. Install insulation of clean, dry piping.
- B. Insulation shall be wrapped tightly on the piping with all circumferential joints and longitudinal joints overlapped a minimum of 2" with facing to the outside to obtain specified R-value using a maximum of 25% compression.
- C. Provide vapor retarder at penetrations, joints, seams and damage to the facing with staples and FSK foil tape. The facing shall be taped with a minimum 3" wide strip of reinforced foil tape. Pressure-sensitive tape shall be a minimum 3" (76mm) wide and shall be applied with moving pressure using an appropriate sealing tool. Staples shall be outward cinch and placed 6" (152mm) on center.
- D. Mechanical / Electrical rooms and above ceilings are considered concealed spaces.

3.6 MISCELLANEOUS

- A. Install materials after piping has been tested and approved.
- B. Apply insulation on clean, dry surfaces only.
- C. Apply weather protective finish on elastomeric insulation installed in non-conditioned spaces. Provide a minimum of three coats.

3.7 INSULATION THICKNESS

<u>INSULATED UNIT</u>	<u>THICKNESS</u> <u>(Inches)</u>
Exposed Roof Drain Bodies and Horizontal Roof Drain Leaders	1
Exposed Roof Overflow Drain Bodies and Horizontal Drain Leaders	1
Domestic Cold Water/Make-Up Water Piping/Drinking Chilled Water	1
Horizontal Sanitary Drain Piping Which Receives Condensate	1
Domestic Hot Water Piping, 1-1/2" Pipe and Smaller	1
Domestic Hot Water Piping, 2" Pipe and Larger	1-1/2

END OF SECTION

**SECTION 22 1116
DOMESTIC WATER PIPING AND APPURTENANCES**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install domestic hot and cold water piping.

1.2 RELATED WORK

- A. Division 22 Plumbing
 - 1. Valves, Strainers and Vents
 - 2. Pipe and Pipe Fittings - General
 - 3. Plumbing Piping Insulation
 - 4. Plumbing Fixtures and Fixture Carriers

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

- A. Below Slab on Grade Piping. Furnish ASTM B 88 and ANSI/NSF Standard 61 annealed tempered (soft), Type K copper water tube. Run continuous with no joints under the floor slab. Provide copper pipe corrosion protection as specified in this Section.
- B. Above Slab Piping. Provide seamless ASTM B 88 and ANSI/NSF Standard 61 drawn tempered (hard) Type L copper water tube with wrought copper or bronze fittings with solder-joints, ANSI B16.22. Solder material shall be 95-5 (lead free) (Tin-Antimony-Grade 95TA) ASTM B 32.
- C. Unions. Provide 150 lb. standard unions with ground joint and bronze seat. Flange joints larger than 2 inches. Provide dielectric isolating unions at junctions or connection between metallic piping of dissimilar metal. Provide pipe threads with standard taper pipe threads ANSI B2.1.
- D. Alternate Method of Joining Copper Pipe and Tubing: Press Fittings: Copper press fitting shall conform to the material and sizing requirements of ASME B16.51. O-rings for copper press fittings shall be EPDM. VIEGA. The system intended for use shall be approved by submittal. Systems from various manufacturers may vary in technology. The field personnel shall carry training credentials from the approved manufacturer for the project. Mixing of fittings from different manufacturers is strictly prohibited.

2.2 WATER HAMMER ARRESTORS

- A. Provide piston type hydraulic engineered/manufactured water hammer arrestors in cold and hot water supply lines in chases or walls to each fixture branch or battery of fixtures serving quick closing valves of electrical, pneumatic, spring loaded type, or quick hand closure valves on fixture trim. Provide water hammer arrestors at the end of the branch line between the last two fixtures served. Provide Precision Plumbing Products, Inc., or equal. Size units according to water hammer arrestor's Standard PDI WH-201; refer to schedule on drawings.
- B. Install all water hammer arrestors so as to attain 100% effectiveness according to Plumbing and Drainage Institute PDI-WH201 Table 5, 6 and 6-A for water hammer arrestors.
- C. All water hammer arrestors shall be installed in a vertical position.
- D. All water hammer arrestors shall be accessible and shall have access panels where required. Arrestors located above ceilings in fixture drops will not be acceptable. Refer to sizing and placement data as indicated in PDI Standard PDI-WH-201.

PART 3 - EXECUTION

3.1 DRAINAGE

- A. Install water piping systems with uniform horizontal grade of 1/8 inch per 10 foot, minimum, to low points to provide complete system drainage. Where constant pitch cannot be maintained for long runs, establish intermediate low points and rise to new level. Grade

branches to drain to mains or risers. Unless otherwise indicated, terminate low points of risers with drain valve piped to nearest hub or floor drain.

3.2 STERILIZATION

- A. Prior to starting work, verify system is complete, flushed and clean.
- B. Inject chorine disinfectant in liquid, powder, tablet or gas form throughout the system to obtain 50 to 80 Mg/L residual.
- C. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 20% of the outlets.
- D. Retain disinfectant in system for 8 hours (minimum), 24 hours (maximum). During the disinfection process, operate all valves and accessories.
- E. If final disinfectant residual tests less than 25 Mg/L, repeat treatment.
- F. Flush disinfectant from system until chemical and bacteriological tests prove water quality equal to that of the service main.
- G. Take samples no sooner than 24 hours after flushing from at least 10% of the outlets and from the water entry.
 - 1. Obtain a minimum of one water sample flushing from at least 10% of the outlets and from the water entry.
 - 2. Take samples from faucets located at highest point in the building, and farthest point from the main water supply.
- H. After final flushing, remove aerators, clean and replace.
- I. Chemical and bacteriological tests shall be conducted by a state certified laboratory.
- J. The firm performing the disinfection shall have chemical laboratory experience.
- K. Provide a laboratory report to indicate the following information.
 - 1. Name and address of the approved laboratory testing the samples.
 - 2. Name and location of the project and date the samples were obtained.
 - 3. Mg/L chlorine during retention.
 - 4. Mg/L chlorine after flushing.
 - 5. The coliform organism count. (An acceptable test shall show absence of coliform organisms.)
- L. If analysis does not satisfy the specified minimum requirements, repeat the disinfection procedure.
- N. Submit for approval to the Architect/Engineer a copy of the laboratory report and the certification of performance. An approved copy of each document shall be inserted in the Owner's manual.

3.3 UNDERGROUND WATER PIPING SYSTEM PROCEDURES

- A. Lay sewer and water lines in separate trenches, separated by 10 foot of undisturbed or compacted soil.

3.4 TESTING

- A. Test under a cold water hydrostatic pressure of 1-1/2 times operating pressure (150 psig minimum) and carefully check for leaks. Repair leaks and retest system until proven watertight.
- B. Test the domestic water piping system at 150psig hydrostatic pressure, maintained for 6 hours.
- C. Use only potable water for the test.
- D. Perform the test before fixtures, faucets, trim or final connections are made to equipment.
- E. If the system is tested in sections, the entire domestic water piping system shall be submitted to a final test, employing the specified procedure.
- F. Do not insulate or conceal piping systems until tests are satisfactorily complete.
- G. If any leaks or other defects are observed, suspend the test and correct the condition at once. Repeat testing until leaks are eliminated and the full test period is achieved.

- H. The satisfactory completion of testing does not relieve the Contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories.

3.5 COPPER PIPE CORROSION PROTECTION

- A. Corrosion protect copper tube piping systems:
 - 1. In the building slab.
 - 2. Beneath the building slab.
 - 3. Buried.
 - 4. Route plasti-sleeve 0.006 thick material entire length of below slab on grade copper tubing.
- B. Cover copper tubing piping system with:
 - 1. "Tapecoat" TC Primer.
 - 2. "Tapecoat" CT cold applied coating tape.
- C. Install coating system as specified by the manufacturer.
- D. Extend the corrosion protection 2 inches above concrete slab on grade.

3.6 TEST OF PIPE CORROSION PROTECTION SYSTEM

- A. Test the pipe corrosion protection coating with an approved high voltage tester adjusted to provide sufficient voltage to produce a spark through a pinhole in the coating (at least 15 kv AC).
- B. Make repairs to small holes in accordance with the manufacturer's instructions.
- C. Retest the repairs using procedures listed above.
- D. Furnish certificate of compliance with field testing in Owner's manual.

END OF SECTION

**SECTION 22 1123
DOMESTIC WATER PUMPS**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. General characteristics for pumps specified in Division 22 - Plumbing.

1.2 RELATED WORK

Requirements for pumps are specified in other sections of Division 22 - Plumbing, including the following:

- A. Division 22 Plumbing - Electrical Provisions of Plumbing Work.

1.3 PUMP SELECTION

- A. Select pumps conservatively for scheduled conditions. Furnish pumps that have reasonably high efficiencies, with peak efficiency at or near rated conditions. Select pumps that will operate stably at 15' suction lift despite substantial reduction in head or substantial increase in delivery.
- B. If the pumps proposed are not considered suitable, submit manufacturer's data on other pumps, for review.
- C. Scheduled design flow, design head, pump efficiency, and motor horsepower are the minimum acceptable.
- D. The pump curve shall rise continuously from maximum flow to cut-off.
- E. Shut-off head approximately 10 percent greater than design head, unless otherwise indicated in pump schedules.
- F. Pump brake horsepower shall not exceed the motor horsepower rating over the entire operating range from shut-off to run-out.
- G. Select the pump for operation at or near peak efficiency.
- H. Cavitation-free at all points on the curve.
- I. Impeller diameter shall not exceed 90 percent of the maximum published diameter.

1.4 PUMP SIZE AND TYPE

- A. Provide motor-driven pumps of the type and speed scheduled. Select pumps that are not overloaded throughout the entire range of pump operation. Provide pump connection sizes as indicated.
- B. Submit copies of manufacturer's performance curves, as shop drawings on each pump. Clearly mark the curves for each pump to indicate the diameter of the impeller and the selection point.

1.5 CERTIFIED DATA

- A. Submit factory certified pump curves showing pump performance characteristics with pump and system operating points plotted. Curves shall include as a minimum, flow (gallons per minute), head (feet of water), all available impeller diameters (inches), efficiency (percent), net positive suction head required (feet of water), brake horsepower, pump size and pump model. Show pump curves with system curve plotted.

PART 2 - PRODUCTS

2.1 DOMESTIC HOT WATER CIRCULATING PUMPS (SMALL) FRACTIONAL HORSEPOWER

- A. Pump Construction:
 - 1. Wet-rotor, in-line, single stage
 - 2. Bronze housings with 1/2" and 3/4" sweat connections

3. Stainless steel housing with union threaded connections
 4. Integrated check valve inside union fitting on a sweat pump housing
 5. Built-in 5-foot, 115 volt AC line cord with NEMA 3 Prong male plug or line cord
 6. Built-in timer
 7. Aquastat thermostatic control
- B. Acceptable manufacturers:
1. Armstrong
 2. Grundfos

2.2 FLOW INDICATOR

- A. Flow Indicator
1. Bronze Construction
 2. Rotating wheel
 3. Line Size
 4. Double Window
 5. Ernst Flow Industries Model EFI E-57-3

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install the pumps in accordance with Manufacturer's "Installation, Start-up and Service Instructions".
1. Provide access space around pumps for service.
 2. Lubricate pumps prior to start-up.
 3. Install hot water circulator horizontally, properly supported to wall, in an accessible location for testing and maintenance at a height not to exceed 60" above finished floor. Install line size Ernst bronze rotating wheel, flow indicator with double window, downstream of circulator.
- B. Provide a line size isolation valve and strainer on the pump suction and a line size silent check valve and balancing valve on the pump discharge.
- C. Support piping adjacent to the pump such that no weight is carried on the pump casing. Decrease from pipe size with eccentric reducer on suction side and concentric increaser on discharge side.
- D. Ensure pumps:
1. Operate at specified system fluid temperatures without vapor binding and cavitation.
 2. Are non-overloading in parallel and individual operation.
 3. Operate within 25 percent of midpoint of published maximum efficiency curve.
- E. Refer to pump detail on the Contract Drawings for piping accessories to be provided.

3.2 ALIGNMENT FOR BASE MOUNTED PUMPS

- A. Set the pump on a concrete inertia base or concrete housekeeping pad as specified. Anchor, level and grout.
- B. Align the pump and driver in accordance with Hydraulic Institute Standards for centrifugal, rotary and reciprocating pumps.
- C. Realign the pump and driver after initial leveling of pump base before placing the grout and again after the grout has set and the foundation bolts are tightened. Recheck the alignment after the piping has been connected.

3.3 MANUFACTURER START-UP SERVICE ALIGNMENT

- A. After installation, the pumps and motors are to be aligned by the manufacturer or their representative utilizing a dial indicator. After completion, a formal report must be submitted by the Manufacturer to the Engineer prior to final acceptance. This report must include pump serial number, location, beginning and final alignment at a minimum.

1. Technicians, as required, shall be trained and experienced in the work they perform (Contractor start-up / alignment is unacceptable).
- B. Before starting pumps, but after connecting piping:
 1. Align shafts and coupling with a precision dial indicator alignment instrument to the minimum tolerances .004 (TIR) per inch of coupling radius or as recommended by the manufacturer, whichever is the greater.
 2. Tabulate the actual pump alignment reading with manufacturer's minimum tolerances.
 3. Submit readings for approval.
 4. Include the approved readings in the Owner's Maintenance Manual.

3.4 FINAL PUMP FLOW CALIBRATION

- A. Based on the results of the final phases of the test and balance sequences, if the flow of the unthrottled pump is more than 10% above the scheduled values:
 1. Request detailed instructions from the pump manufacturer for the correct impeller diameter.
 2. Trim the impeller to the diameter recommended by the manufacturer, employing precision machinery.
- B. Enter the information on the final configuration of the pump in the Owner's Manual.
 1. Modify the pump nameplate to reflect the correct head and flow data and the impeller diameter.

3.5 SPARE PARTS

- A. Provide the following spare parts and material to the Owner for his use after the warranty period.
 1. A mechanical seal for each pump
 2. A set of bearings for each pump

END OF SECTION

SECTION 22 2000
PLUMBING PIPE AND PIPE FITTINGS - GENERAL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install pipe and pipe fittings for piping systems specified in Division 22 - Plumbing.

1.2 RELATED WORK

- A. Division 22 Plumbing
 - 1. Earthwork
 - 2. Valves, Strainers and Vents
 - 3. Insulation
 - 4. Other Piping Sections

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. The particular type of pipe and fittings for each system is specified in the individual sections.

2.2 JOINTS

- A. Make screwed joints using machine cut USASI taper pipe threads. Apply a suitable joint compound to the male threads only. Ream the pipe to full inside diameter after cutting. All-thread nipples are not permitted.
- B. Dissimilar Metals. Make joints between copper and steel pipe and equipment using insulating unions or couplings such as Crane Company #1259; EPCO as manufactured by EPCO Sales, Inc.; or an approved equal.
- C. Solder joints.
 - 1. Prior to making joints, cut pipe square and ream to full inside diameter. Clean exterior of pipe and socket. Apply a thin coat of suitable fluxing compound to both pipe and socket, and fit parts together immediately.
 - 2. Heat assembled joint only as required to cause the solder to flow. Run the joint full, slightly beaded on the outside, and wipe to remove excess solder.
 - 3. Use silver brazing alloy or Sil-Fos on underground water entry piping. Use lead free solder on all other copper piping.
- D. Make welded joints as recommended by the standards of the American Welding Society. Ensure complete penetration of deposited metal with base metal. Provide filler metal suitable for use with base metal. Keep inside of fittings free from globules of weld metal. The use of mitered joints is not approved.
- E. Flanged.
 - 1. Prior to installation of bolts, center and align flanged joints to prevent mechanical pre-stressing of flanges, pipe or equipment. Align bolt holes to straddle the vertical, horizontal or north-south centerline. Do not exceed 3/64" per foot inclination of the flange face from true alignment.
 - 2. Use flat-face companion flanges only with flat-faced fittings, valves or equipment. Otherwise, use raised-face flanges.
 - 3. Install gaskets suitable for the intended service and factory cut to proper dimensions. Secure with manufacturers recommended gasket cement.
 - 4. Use ANSI nuts and bolts, galvanized or black to match flange material. Use ANSI 316 stainless steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Draw bolts tight to ensure proper seating of gaskets.
 - 5. Use carbon steel flanges conforming to ANSI B16.5 with pipe materials conforming to ASTM A 105 Grade II or ASTM A 108, Grade II, ASTM A 53,

- Grade B. Use slip-on type flanges on pipe only. Use welding neck type flanges on all fittings. Weld slip-on flanges inside and outside.
6. Keep flange covers on equipment while fabricating piping. Remove when ready to install in system.
- F. No Hub. Hubless joints shall be made with wide body, neoprene sealing sleeve with stainless steel sleeve, coupling joints conforming to ASTM C 1277.
- 4" pipe size and smaller coupling housing minimum of 3" width; 24 gauge Series 300 stainless steel with hi-torque clamps; neoprene coupling gasket.
 - 6" through 10" pipe size coupling housing minimum of 4" width.
 - Tighten clamps to within manufacturer's tolerances using preset torque wrench.
- I. Compression Gasket System. Bell and spigot cast iron pipe 4" and smaller, use flax-base lubricant, Tyler Ty-Seal Lubricant or Charlotte Regular Lubricant. 6" and larger use a neoprene base lubricant, Charlotte Adhesive Lubricant.
- J. Ring-Tite Joints: Furnish joints for installation according to manufacturer's recommendations. Provide adequate concrete thrust blocks at changes in direction, as recommended by manufacturer. JM Eagle pressure rated PVC water pipe. ASTM D2241 pressure rating, ASTM D3219 joints, gaskets ASTM F477.
- M. Press fittings for copper pipe 1/2" to 4": Copper press fittings shall conform to the material and sizing requirements of ASTM B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM. Pro-Press System manufactured by VIEGA. The system intended for use shall be approved by submittal. Systems from various manufacturers may vary in technology. The field personnel shall carry training credentials from the approved manufacturer for the project. Mixing of fittings from different manufacturers is strictly prohibited.

2.3 UNIONS

- A. Use 150 lb. standard (300 lb. WOG) malleable iron, ground joint unions with bronze seat. Provide flanged joints on piping 2-1/2" and larger.
- Where pipe materials of different types join, use a dielectric union. Union shall be threaded, solder or as required for its intended use.

2.4 BRANCH CONNECTIONS

- A. Pipe 2" and Smaller. For threaded piping, use straight size reducing tee. When branch is smaller than header, a nipple and reducing coupling or swagged nipple may be used.
- B. 2-1/2" through 36": For welding piping, when branch size is the same as header size, use welding tee. Use Weld-o-let when branch is smaller than header. For threaded branch connections, use 3000 lb. full coupling or Thread-o-let welded to header.

2.5 GASKETS

- A. High Temperature Piping. Provide 1/16" thick ring gaskets of aramid reinforced SBR such as Garlock #3200 or 3400 or equal by Advanced Products and Systems.
- B. Other Piping. Provide ring rubber gaskets, Garlock #7992 or equal by Advanced Products and Systems. Use 1/8" thick cloth reinforced neoprene gaskets. For smaller than 6", use 1/16" thick gasket.

2.6 FLOORS AND CEILING PLATES

- A. Provide chrome-plated floor and ceiling plates around pipes exposed to view when passing through walls, floors, partitions, or ceilings in finished areas; size plates to fit pipe or insulation and lock in place.

2.7 DOMESTIC MANUFACTURE

- A. All piping material, pipe and pipe fittings shall be manufactured in the United States of America unless specifically named in these specifications.

PART 3 - EXECUTION

3.1 PIPE FABRICATION AND INSTALLATION

- A. Make piping layout and installation in the most advantageous manner possible with respect to headroom, valve access, opening and equipment clearance, and clearance for other work. Give particular attention to piping in the vicinity of equipment. Preserve the required minimum access clearances to various equipment parts, as recommended by the equipment manufacturer, for maintenance.
- B. Cut all pipes to measurement determined at the site. After cutting pipe, remove burrs by reaming. Bevel plain ends of ferrous pipe.
- C. Install piping neatly, free from unnecessary traps and pockets. Work into place without springing or forcing. Use fittings to make changes in direction. Field bending and mitering is prohibited. Make connections to equipment using flanged joints, unions or couplings. Make reducing connections with reducing fittings only.
- D. Install piping without tapping out of the bottom of pipe.
- E. Press Connections: Copper press fittings ½” through 4” shall be applied in accordance with the manufacturer’s installation instructions. The tubing/pipe shall be fully inserted into the fitting and the tubing/pipe marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing/pipe to assure the tubing/pipe is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer. If soldering (thread adapters, etc.) near press fittings, take precautions to not damage the O-ring fittings. Maintain three pipe diameters or use a cooling agent. Viega-“Pro-Press”.

3.2 WELD

- A. Weld and fabricate piping in accordance with ANSI Standard B31.1, latest edition, Code for Pressure Piping.
- B. Align piping and equipment so that no part is offset more than 1/16". Set fittings and joints square and true, and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.
- C. Do not permit any weld to project within the pipe so as to restrict flows. Tack welds, if used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welds during welding operation.
- D. Do not split, bend, flatten or otherwise damage piping before, during or after installation.
- E. Remove dirt, scale and other foreign matter from inside piping before tying into existing piping sections, fittings, valves or equipment.
- F. Bevel ends of ferrous pipe.

3.3 OFFSETS AND FITTINGS

- A. Due to the small scale of drawings, the indication of offsets and fittings is not possible. Investigate the structural and finish conditions affecting the work and take steps required to meet these conditions.
- B. Install pipe close to walls, ceilings and columns so pipe will occupy minimum space. Provide proper spacing for insulation coverings, removal of pipe, special clearances, and offsets and fittings.

3.4 SECURING AND SUPPORTING

- A. Support piping to maintain line and grade, with provision for expansion and contraction. Use approved clevis-type or trapeze-type hangers connected to structural members of the building. Single pipe runs to be supported by approved clevis type hangers. Multiple pipe runs to be supported by approved trapeze type hangers. Do not support piping from other piping or structural joist bridging.
- B. Provide supports both sides of elbows for pipe 6" and larger.

- C. Support vertical risers with steel strap pipe clamps of approved design and size, supported at each floor. Support piping assemblies in chases so they are rigid and self-supported before the chase is closed. Provide structural support for piping penetrating chase walls to fixtures. On cold water pipe, supports shall be outside the insulation.
- D. Where insulation occurs, design hangers to protect insulation from damage. Pipe saddles and insulation shields, where required, are specified in the appropriate insulation section and are sized in accordance with the schedule on the drawings.
- E. Install trapeze hangers, properly sized, to support the intended load without distortion.
- F. Use electro-galvanized or zinc plated threaded rods, nuts, washers and hangers.
- G. At outdoor locations, all supports, brackets and structural members shall be hot-dipped galvanized.
- H. Support spacing: As recommended by the project structural engineer and support manufacturer, but not more than listed below. Not to exceed spacing requirements of smallest pipe.

Pipe Size	Copper & Steel Max. Support Spacing, Feet	Cast Iron Max. Support Spacing, Ft.	Minimum Rod Diameter, Inches
1" & smaller	6		3/8
1-1/4" & 1-1/2"	8	5	3/8
2"	10	5	3/8
3"	10	5	1/2
4" & 5"	10	5	5/8
6" and above	10	5	3/4

3.5 PIPE SUPPORTS

- A. Provide P1001 or P 5000 Unistrut metal framing members and appurtenances for pipe support. Hot-dip galvanize members and appurtenances when located outside. Sagging of pipes or supports is not acceptable.
- B. Adjustable clevis hangers shall be used for single pipe supports; Anvil Fig. 260. When oversized clevis is used, a nipple shall be placed over the clevis bolt as a spacer to assure that the lower U-strap will not move in on the bolt. Provide adjustable clevis with a nut / washer above and below the hanger on the support rod. Ring type clevis hangers are not acceptable.
- C. Provide Anvil Figure 45 galvanized or primed and painted channel assembly for trapeze hangers.

3.6 PIPE SUPPORTS ON ROOF

- A. Support gas pipe on roof with Portable Pipe Hanger Model PP-10 with roller and fully adjustable height throughout pipe run. Base material shall be high density / high impact polypropylene with UV inhibitors and anti-oxidants. Provide with hot dip galvanized rod finish and framing. Nuts and washers shall be hot dip galvanized.

3.7 ANCHORS

- A. Provide anchors as required. Use pipe anchors consisting of heavy steel collars with lugs and bolts for clamping to pipe and attaching anchor braces. Install anchor braces in the most effective manner to secure desired results. Do not install supports, anchors or

similar devices where they will damage construction during installation or because of the weight or the expansion of the pipe. When possible, install sleeves in structural concrete prior to pouring of concrete.

3.8 FLOOR PENETRATIONS

- A. At locations where pipe passes through floors, provide watertight concrete curb around penetration.

3.9 PIPE SLEEVES

- A. Sleeves through masonry and concrete construction:
 - 1. Fabricate sleeves of Schedule 40 galvanized steel pipe.
 - 2. Size sleeve large enough to allow for movement due to expansion and to provide continuous insulation.
- B. Sleeves through gypsum wall construction.
 - 1. Fabricate sleeves of 16 gauge galvanized sheet metal.
- C. Sleeves through elevated slab construction.
 - 1. Fabricate sleeves of Schedule 40 galvanized steel pipe with welded center flange in floor.
- D. Extend each sleeve through the floor or wall. Cut the sleeve flush with each wall surface. Sleeves through floors shall extend 2" above floor lines for waterproofing purposes. Slab on grade floors shall not be sleeved except where penetrating waterproofing membrane or insect control is required.
- E. Caulk sleeves water and air tight. Seal annular space between pipes and sleeves with mastic compound to make the space water and air tight.
- F. For sleeves below grades in outside walls, provide Thunderline Link-Seal or Advance Product and System Interlynx, with 316 stainless steel nuts and bolts, with cast iron pressure plate.
- G. Provide chrome plated escutcheon plates on pipes passing through walls, floors or ceilings exposed to view. At exterior walls, stainless steel sheet metal is to be used.
- H. For sleeves through fire and smoke rated walls, seal with a UL through-penetration firestop, rated to maintain the integrity of the time rated construction. Install in accordance with the manufacturer's installation instructions. Comply with UL and NFPA standards for the installation of firestops. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

3.10 ISOLATION VALVES

- A. Provide piping systems with line size shutoff valves located at the risers, at main branch connections to mains for equipment, to isolate central plant, and at other locations.

3.11 DRAIN VALVES

- A. Install drain valves at low points of water piping systems so that these systems can be entirely drained. Install a line size drain valve for pipes smaller than 2" unless indicated otherwise. For pipes 2-1/2" and larger, provide 2" drain valves unless indicated otherwise. Drain valves shall be plugged when not in use and at completion.

3.12 CLEANING OF PIPING SYSTEMS

- A. General cleaning of piping systems. Purge pipe of construction debris and contamination before placing the systems in service. Provide and install temporary connections as required to clean, purge and circulate.
- B. Install temporary strainers at the inlet of pumps and other equipment as necessary where permanent strainers are not indicated. Keep strainers in service until the equipment has been tested, then remove either entire strainer or straining element only. Fit strainers with a line size blow down ball valve and pipe to nearest drain. Blow down strainers, remove

- and clean as frequently as necessary.
- C. Phase One: Initial flushing of system. Remove loose dirt, mill scale, weld beads, rust and other deleterious substances without damage to system components. Open valves, drains, vents and strainers at all system levels during flushing procedures. Flush until “potable water clear” and particles larger than 5 microns are removed.
 - D. Connect dead-end supply and return headers, even if not shown on the drawings, and provide terminal drains in bottom of pipe end caps or blind flanges.
 - E. Dispose of water in approved manner.
 - F. Phase Two: Cleaning of Piping Systems. Remove, without chemical or mechanical damage to any system component, adherent dirt (organic soil), oil, grease, (hydrocarbons), soldering flux, mill varnish, piping compounds, rust (iron oxide) and other deleterious substances not removed by initial flushing. Flush system and replace with clean water.
 - G. Phase Three: Final flushing and rinsing: Flush and rinse until “potable water clear” and particles larger than 5 microns are removed. Operate valves to dislodge any debris in valve body. Dispose of water in approved manner.
 - H. Submit status reports upon completion of each phase of work on each system.

3.13 TESTING

- A. Test piping after installation with water hydrostatic pressure of 1-1/2 times operating pressure (150 psig minimum) and carefully check for leaks. Repair leaks and retest system until proven watertight.
- B. Do not insulate or conceal piping systems until tests are satisfactorily complete.
- C. If any leaks or other defects are observed, suspend the test and correct the condition at once. Repeat testing until leaks are eliminated and the full test period is achieved.
- D. The satisfactory completion of testing does not relieve the Contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories.

3.14 PIPE MARKERS

- A. Identify interior exposed piping and piping in accessible chases or plenums with Opti-Code Brady Pressure Sensitive Adhesive Pipe Markers, consisting of pipe marker and direction of flow arrow tape. Clean pipe prior to installation. Background colors of markers, arrows and tape for each type of system shall be the same. Meet ANSI/OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.
- B. Identify exterior and mechanical room piping with Snap Around pipe markers through 4-inch pipe and Strap Around markers 5-inch pipe and larger. Pipe markers consisting of pipe marker and direction of flow arrow tape; background colors of markers, arrows and type for each type of system shall be the same. Meet ANSI / OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.
- C. Install identification in the following locations:
 - 1. Both sides of penetrations through walls, floors and ceilings.
 - 2. Close to valves or flanges.
 - 3. Intervals on straight pipe runs not to exceed 50 feet
 - 4. Apply marker where view is obstructed.
- D. Pipe markers shall meet or exceed the specifications of the ASME A13.1 “Scheme for Identification of Piping Systems”.

END OF SECTION

SECTION 22 3333
ELECTRIC WATER HEATER (Commercial ASME)

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Electric water heaters for domestic water systems.

1.2 RELATED WORK

- A. Division 22 Plumbing
 - 1. Domestic Water Piping.
 - 2. Plumbing Piping Insulation.
 - 3. Division 26 Electrical.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Lochinvar.
- B. State.
- C. Rheem / Ruud
- D. A. O. Smith

2.2 PRODUCTS

- A. Provide electric water heaters with kilowatt, recovery ratings, and storage capacities as scheduled on drawings.
- B. Provide an ASME code construction tank designed for 150 psig working pressure. Furnish glass-lined tank. Lining shall be corrosion-resistant.
- C. Furnish factory-assembled, integral units equipped as follows:
 - 1. Immersion thermostat.
 - 2. High temperature limit switch (energy cutout).
 - 3. Low-water cutoff.
 - 4. Heavy duty UL rated for 100,000 cycles.
 - 5. Temperature and pressure relief valve.
 - 6. Anode rod.
- D. Provide heavy-duty, medium watt density elements having nicoloy sheathing and prewired leads.
- E. The entire vessel shall be enclosed in a round steel enclosure with baked enamel finish and shall enclose the tank with R-16 foam insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- B. All installations shall be in accordance with the manufacturer's published recommendations.
- C. Furnish all supports required by the equipment included in this Contract.
- D. Provide a 4" thick reinforced concrete housekeeping pad beneath heaters.
- E. Furnish and install all necessary valves, traps, gauges, strainers, unions, etc. to facilitate proper functioning and servicing of equipment.
 - 1. Install a line size shutoff valve in cold water inlet and hot water outlet close to each heater.
 - 2. Provide a temperature gauge in the domestic hot water piping within five feet of outlet to each heater, upstream of all shut-off valves. Size and locate gauges to be easily readable from a standing position.

- F. Provide dielectric isolation device where copper lines connect to ferrous lines or equipment, such as dielectric coupling or dielectric flange fitting.
- G. Route condensate to a vented receiver.
- H. Pipe relief valve discharge and all equipment drains indirectly to appropriate floor drain.
- I. Set the operating and safety controls.
- J. Set thermostats on domestic water heaters to delivery maximum water temperature as indicated on Contract Drawings.
- K. Furnish and install an expansion tank on cold water supply to heater. Locate tank as close to water heater as possible between water heater and all check valves or backflow preventers. Expansion tank capacity shall be as scheduled on Contract Drawings. Install expansion tank in accordance with manufacturer's recommendations.
- L. Install water heater in galvanized drain pan piped to floor drain. Elevate water heater tank bottom above drain pan as to not allow standing water inside of drain pan to touch bottom of tank.

3.2 STARTUP

- A. Startup shall be performed by factory trained and authorized personnel. The factory representative shall also provide a technical and practical operation and maintenance training seminar including a hands-on operation and maintenance demonstration, and classroom presentation with handouts and visual aids, for no less than three physical plant personnel.

END OF SECTION

SECTION 22 4000
PLUMBING FIXTURES AND FIXTURE CARRIERS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install water closets, urinals, lavatories, electric drinking fountains, fixture carriers and plumbing appurtenances.

1.2 RELATED WORK

- A. Division 22 Plumbing
 - 1. Drains, Hydrants and Cleanouts.
 - 2. Domestic Water Piping.
 - 3. Soil, Waste and Sanitary Drain Piping and Vent Piping.

1.3 JOB REQUIREMENTS

- A. Furnish plumbing fixtures and trim as shown and specified. Provide faucets, fittings, supply stops and similar devices of a single manufacturer. Furnish faucets and supply stops with renewable seats. Porcelain to steel and enameled cast iron fixtures shall be acid resistant. Wall hung fixtures shall be installed with a fixture carrier.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Plumbing Fixtures (Vitreous China):
 - 1. American Standard.
 - 2. Kohler.
 - 3. Toto
 - 4. Zurn
 - 5. Sloan
- B. Plumbing Faucets:
 - 1. American Standard.
 - 2. Chicago.
 - 3. Zurn
 - 4. Moen Commercial
- C. Supports and Carriers:
 - 1. Wade
 - 2. Zurn
 - 3. J.R. Smith.
 - 4. Josam.
 - 5. Watts
- D. Flush Valves:
 - 1. Sloan
 - 2. Zurn
 - 3. Moen Commercial
 - 4. Toto
- E. Supplies, Stops and Chrome Plated Tubular Brass:
 - 1. McGuire
 - 2. T&S Brass
- F. Water Closet Seats:
 - 1. Beneke
 - 2. Church
 - 3. Olsonite
 - 4. Bemis
 - 5. Centoco

- G. Electric Drinking Fountains:
(No electronic solenoid valves; only mechanically operated valves.)(No Filtered Units)
 - 1. Halsey Taylor
 - 2. Elkay
- H. Electric Drinking Fountains (Bi-Level with Bottle Filler)
 - 1. Halsey Taylor Model HTHBHVRBBL-NF with filter. Model HWF 3000 for bottle filler
 - 2. Elkay Model VRCGRNTL8WSK with filter. Model HWF 3000 for bottle filler
- I. Floor Drains:
 - 1. Wade
 - 2. J.R. Smith
 - 3. Josam
 - 4. Zurn
 - 5. Watts
- J. Cleanouts:
 - 1. Wade
 - 2. J.R. Smith
 - 3. Josam
 - 4. Zurn
 - 5. Watts
- K. Stainless Steel Sinks:
 - 1. Elkay
 - 2. Moen Commercial
- L. Roof Drains:
 - 1. Wade
 - 2. J.R. Smith
 - 3. Josam
 - 4. Zurn
 - 5. Watts
- M. Thermostatic Mixing Valves
 - 1. Symmons
 - 2. Leonard
- N. Shock Arrestors:
 - 1. Precision Products
 - 2. Sioux Chief
- O. Backflow Preventors
 - 1. Apollo RPLF 4A Series for 2-1/2 inch and larger
 - 2. Febco
 - 3. Watts
- P. Hose Bibbs
 - 1. Wade
 - 2. Chicago
 - 3. Josam
 - 4. Woodford
 - 5. Zurn
 - 6. J.R. Smit
- Q. Wall Hydrants
 - 1. Wade
 - 2. Woodford
 - 3. Zurn
 - 4. J.R. Smith
 - 5. Josam
- R. Solids Interceptors

1. Wade
2. J.R. Smith
3. Zurn
4. Josam

2.2 REQUIREMENTS

- A. Refer to the drawings for equipment to be supplied.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with the manufacturer's instructions.
- B. Make rough-in and final connection of service to each fixture provided under this Section and other Sections or Architectural or Plumbing Drawings.
- C. Provide necessary stops, valves, traps, unions, vents, cold water, hot water, sanitary, etc. for a complete installation.
- D. Provide isolation valves in domestic water lines to isolate all equipment, restrooms, hose bibbs, and where shown on drawings.
- E. Remove piping and services roughed-in incorrectly and install correctly, without cost.
- F. Exposed piping, fittings and appurtenances shall be chrome-plated brass.
- G. Coordinate with the Contractor for locations and service required for each plumbing fixture.
- H. All floor drains and floor sinks shall have trap primer connections. Provide trap primer valves and 1/2-inch water line to each floor drain connection. Trap primer supply line shall have ball valve and Y strainer on inlet side of trap primer valve to facilitate cleaning.
- I. All floor drains and floor sink locations are to be coordinated with all equipment. Locate drains in mechanical equipment spaces to conform to drain locations of equipment furnished. Coordinate drain location with food service equipment and Architectural Drawings.
- J. All floor drains, floor sinks and cleanout covers are to be provided with stainless steel screws. (No Vandal Resistant Screws)
- K. Trap primer valves installed in concealed spaces shall have approved access doors for accessibility.

END OF SECTION

SECTION 23 0100
HVAC OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Compilation product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified.
- B. Instruct Owner's personnel in operation and maintenance of equipment and systems.
- C. Submit three copies of complete manual in final form.

1.2 SUBMITTALS

- A. Thirty (30) days after the Contractor has received the final scheduled identified submittals bearing the Architect/Engineer's stamp of acceptance (including resubmittals), submit for review one copy of the first draft of the Operating and Maintenance Manual. This copy shall contain as a minimum:
 - 1. Table of Contents for each element.
 - 2. Contractor information.
 - 3. All submittals, coordination drawings and product data, reviewed by the Architect/Engineer; bearing the Architect/Engineer's stamp of acceptance. (When submittals are returned from Engineer "Correct as Noted", corrected inserts shall be included.)
 - 4. All parts and maintenance manuals for items of equipment.
 - 5. Warranties (without starting dates)
 - 6. Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
 - 7. Operating and maintenance procedures.
 - 8. Form of Owner's Training Program Syllabus (including times and dates).
 - 9. Control operations/equipment wiring diagrams.
 - 10. Schedule of filters for each item of equipment.
 - 11. Schedule of belts for each item of equipment.
 - 12. Other required operating and maintenance information that are complete.
- B. Copy will be returned to the Contractor within 15 days with comments for corrections.
- C. Submit three (3) completed manuals in final form to the Architect/Engineer one day after substantial completion, and prior to Owner's instructions. Include all specified data, test and balance reports, drawings, dated warranties, certificates, reports, along with other materials and information.
- D. The Architect/Engineer will review the manuals for completeness within fifteen (15) days.
- E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.
- F. Two (2) complete Manuals will be delivered to the Owner.

PART 2 - PRODUCTS

2.1 BINDERS

- A. Commercial quality black three-ring binders with clear overlay plastic covers.
- B. Minimum ring size: 1".
Maximum ring size: 3".
- C. When multiple binders are used, correlate the data into related groupings.
- D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals:
1. Prepare data in form of an instructional manual for use by Owner's personnel.
 2. Format:
 - a. Size: 8-1/2" x 11".
 - b. Text: Manufacturer's printed data or neatly typewritten.
 3. Drawings:
 - a. Provide reinforced punched binder tab and bind in text.
 - b. Fold larger drawings to size of text pages.
 4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
 5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
 - a. Title of Project
 - b. Identity of separate structures as applicable.
 - c. Identity of general subject matter covered in the manual.
 6. Binder as specified.
- B. Content of Manual:
1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
 - a. Contractor, name of responsible principal, address and telephone number.
 - b. A list of each product required to be included, indexed to content of the volume.
 - c. List with each product, name, address and telephone number of:
 - 1) Subcontractor or installer.
 - 2) Maintenance contractor as appropriate.
 - 3) Identify area of responsibility of each.
 - 4) Local source of supply for parts and replacement.
 - d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
 2. Product Data:
 - a. Include those sheets pertinent to the specific product.
 - b. Annotate each sheet to:
 - 1) Identify specific product or part installed.
 - 2) Identify data applicable to installation.
 - 3) Delete references to inapplicable information. (All options not supplied with equipment shall be marked out indicated in some manner.
 3. Drawings:
 - a. Supplement product data with drawings as necessary to illustrate:
 - 1) Relations of component parts of equipment and systems.
 - 2) Control and flow diagrams.
 - b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
 - c. Do not use Project Record Documents as maintenance drawings.
 4. Written text, as required to supplement product data for the particular installation:
 - a. Organize in consistent format under separate headings for different procedures.
 - b. Provide logical sequence of instructions for each procedure.

5. Copy of each warranty, bond and service contract issued.
 - a. Provide information sheet for Owner's personnel, giving:
 - 1) Proper procedures in event of failure.
 - 2) Instances that might affect validity of warranties or bonds.
 6. Shop drawings, coordination drawings and product data as specified.
- C. Sections for Equipment and Systems.
1. Content for each unit of equipment and system as appropriate:
 - a. Description of unit and component parts.
 - 1) Function, normal operating characteristics, and limiting conditions.
 - 2) Performance curves, engineering data and tests.
 - 3) Complete nomenclature and commercial number of replaceable parts.
 - b. Operating procedures:
 - 1) Start up, break-in, routine and normal operating instructions.
 - 2) Regulation, control, stopping, shut down and emergency instructions.
 - 3) Summer and winter operating instructions.
 - 4) Special operating instructions.
 - c. Maintenance procedures:
 - 1) Routine operations
 - 2) Guide to trouble-shooting.
 - 3) Disassembly, repair and reassembly.
 - 4) Alignment, adjusting and checking.
 - 5) Routine service based on operating hours.
 - d. Servicing and lubrication schedule. List of lubricants required.
 - e. Manufacturer's printed operating and maintenance instructions.
 - f. Description of sequence of operation by control manufacturer.
 - g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
 - 1) Predicted life of part subject to wear.
 - 2) Items recommended to be stocked as spare parts.
 - h. As installed control diagrams by controls manufacturer.
 - i. Complete equipment internal wiring diagrams.
 - j. Schedule of filters for each air handling system.
 - k. Schedule of belts for each item of equipment.
 - l. Each Contractor's coordination drawings.
 - m. As installed color coded piping diagrams.
 - n. Charts of valve tag number, with location and function of each valve.
 - o. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
 - p. Other data as required under pertinent sections of the specifications.
 2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
 3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications.
 4. Provide complete information for products specified in Division 23.
 5. Provide certificates of compliance as specified in each related section.
 6. Provide start up reports as specified in each related section.
 7. Provide signed receipts for spare parts and material.
 8. Provide training report and certificates.
 9. Provide extended compressor warranty certificates.

END OF SECTION

SECTION 23 0400
ARCHITECTURAL REQUIREMENTS FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Size, Weight, Fall Protection and Screening Requirements for HVAC Unit Field Modifications

1.02 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: Submittal procedures, project meetings, progress schedules and documentation, reports, coordination.
- B. Section 01 6000 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.
- C. Division 23 - Heating, Ventilating and Air Conditioning

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the installation of all HVAC equipment with size, weight, fall protection and screening requirements for HVAC Units.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Provide engineered drawings stating compliance with this specification section.
- C. Provide sightline study to verify compliance with this specification section.

1.05 QUALITY ASSURANCE

- A. Work covered by this section of the specifications shall conform to the contract documents, as well as state and local codes.
- B. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in Texas.
- C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- D. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.
- E. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.06 ARCHITECTURAL REQUIREMENTS

- A. The purpose of these specifications is to define the performance and design standards for modifications of HVAC equipment required for products not listed as "Basis of Design" or relocated due to other coordination parameters.
- B. Coordinate the installation of all HVAC equipment with size, weight, fall protection and screening requirements for HVAC Units and make adjustments as required to comply with state and local codes and ordinances.
- C. Screening:
 - 1. Contractor shall verify that the unit heights and placement for the provided equipment and curbs do not exceed those detailed in the construction documents.

2. If the total height and placement differs from the locations or details of the construction documents, the Contractor shall perform a sightline study to verify compliance with the local screening codes and ordinances and make the required modifications to comply. Contractor shall verify compliance before any parapet walls are constructed or screening equipment is ordered.
- D. Size:
1. Contractor shall verify the size of all units, roof curbs and structural openings for equipment that deviate from the units or openings as detailed in the construction documents and make the required adjustments.
- E. Weight:
1. Contractor shall confirm the weights of the provided equipment and verify compliance with the designed loads shown on the construction documents. If the weights exceed those designed, Contractor shall coordinate with the General Contractor and Structural Detailer to adjust the joist or steel design as required.
- F. Fall Protection:
1. Contractor shall provide fall protection for any unit locations that are modified in the field, where the modifications locate them adjacent to any hazards that require fall protection by state or local codes.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

**SECTION 23 0500
MECHANICAL GENERAL PROVISIONS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 23 Mechanical.
- B. Applicable provisions of this section apply to all sections of Division 23, Mechanical.

1.2 CODE REQUIREMENTS AND FEES

- A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.
- B. Mechanical work shall comply with applicable inspection services:
 - 1. Underwriters Laboratories
 - 2. National Fire Protection Association
 - 3. State Health Department
 - 4. Local Municipal Building Inspection Department
 - 5. Texas Department of Licensing & Regulations (ADA)
- C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.
- D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.
- E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

- A. An approved contractor for the work under this division shall be:
 - 1. A specialist in this field and have the personnel, experience, training, skill, and organization to provide a practical working system
 - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that has served their Owners satisfactorily for not less than 3 years

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

- A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet specified capacities.

1.5 CONTRACT DRAWINGS

- A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

1.6 PROJECT RECORD DOCUMENTS

- A. Maintain at the job site a separate set of white prints (black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various lines, valves, ductwork,

- traps, equipment, and other pertinent items, as installed. Include flow-line elevation of sewer lines. Record existing and new underground and under slab piping with dimensioned locations and elevations of such piping.
- B. At the conclusion of project, obtain without cost to the Owner, erasable mylars of the original drawings and transfer as-built changes to these. Prior to transmittal of corrected drawings, obtain 3 sets of blue-line prints of each drawing, regardless of whether corrections were necessary and include in the transmittal (2 sets are for the Owner's use and one set is for the Architect/Engineer's records). Delivery of these as-built prints and reproducibles is a condition of final acceptance. Provide record drawings on one set each (reproducible Dayrex mylar film positives) and AutoCad 2014 files on disk (CD Rom).
- C. As-Built drawings should indicate the following information as a minimum:
1. Indicate all addendum changes to documents.
 2. Remove Engineer's seal, name, address and logo from drawings.
 3. Mark documents RECORD DRAWINGS.
 4. Clearly indicate: DOCUMENT PRODUCED BY
 5. Indicate all changes to construction during construction. Indicate actual routing of all piping, ductwork, etc. that were deviated from construction drawings.
 6. Indicate exact location of all underground mechanical piping and elevation.
 7. Indicate exact location of all underground electrical raceways and elevations.
 8. Correct schedules to reflect (actual) equipment furnished and manufacturer.
 9. Location and size of all ductwork and mechanical piping above ceiling including exact location of isolation of domestic and mechanical valves.
 10. Exact location of all electrical equipment in and outside of the building.
 11. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
 12. Cloud all changes.

1.7 SPACE REQUIREMENTS

- A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.8 RELATION WITH OTHER TRADES

- A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements.
- B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.
- C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.
- D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.
- E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under that Division. Determine from the Contractor for the various trades, the Owner, and by direction from the Architect/Engineer, the exact location of all items.

1.9 CONCEALED AND EXPOSED WORK

- A. When the word "concealed" is used in connection with insulating, painting, piping, ducts and the like, the work is understood to mean hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is understood to mean open to view.

1.10 GUARANTEE

- A. Guarantee work for 1 year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

- A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

- A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional cost. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

- A. Manufacturers names and catalog number specified under sections of Division 23 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer will be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before bid due date. Submit complete design and performance data to the Engineer.

1.14 OPERATING TESTS

- A. After all mechanical systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect/Engineer. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.15 WARRANTIES

- A. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.16 BUILDING CONSTRUCTION

- A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each sub-contractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 OPENINGS

- A. Framed, cast or masonry openings for ductwork, equipment or piping are specified under other divisions. Drawings and layout work for exact size and location of all openings are

included under this division.

3.2 AIR FILTERS AND PIPE STRAINERS

- A. Immediately prior to substantial completion of the project, inspect, clean and service air filters and strainers. Replace air filters.

3.3 LUBRICATION, REFRIGERANT AND OIL

- A. Provide a complete charge of correct lubricant for each item of equipment requiring lubrication.
- B. Provide a complete and working charge of proper refrigerant, free of contaminants, into each refrigerant system. After each system has been in operation long enough to ensure completely balanced conditions, check the charge and modify for proper operation as required.
- C. Provide a complete charge of special oil for refrigeration use, suitable for operation with refrigerant, in each system.

3.4 HOUSEKEEPING PADS

- A. Provide equipment housekeeping pads under all floor mounted and ground mounted HVAC equipment, and as shown on the drawings.
- B. Concrete work as specified in Division 3.
- C. Concrete pads:
 - 1. 4" high, rounded edges, minimum 2500 psi unless otherwise indicated on the drawings
 - 2. Chamfer strips at edges and corner of forms.
 - 3. Smooth steel trowel finish.
 - 4. Doweled to existing slab
- D. Install concrete curbs around duct penetrations or multiple pipe penetrations.

3.5 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to final inspection, conduct an on-site training program to instruct the Owner's operating personnel in the operation and maintenance of the mechanical systems.
 - 1. Provide the training during the Owner's regular working day.
 - 2. The Instructors shall each be experienced in their phase of operation and maintenance of building mechanical systems and with the project.
- B. Time to be allocated for instructions.
 - 1. Minimum of 40 hours dedicated instructor time.
 - 2. 8 hours on each of 5 days.
- C. Before proceeding with the on-site training program, submit the program syllabus; proposed time and dates; and other pertinent information for review and approval.
 - 1. One copy to the Owner.
 - 2. One copy to the Architect/Engineer.
- D. The Owner will provide a list of personnel to receive instructions, and will coordinate their attendance at the agreed upon times.
- E. Use the operation and maintenance manuals as the basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.
- G. Demonstrate equipment functions (both individually and as part of the total integrated system).
- H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.

- I. Submit a report within one week after completion of the training program that instructions have been satisfactorily completed. Give time and date of each demonstration and hours devoted to the demonstration, with a list of people present.
- J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.
- K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.6 EQUIPMENT IDENTIFICATION

- A. Provide a laminated engraved plastic nameplate on each piece of equipment and starter.
 - 1. Designation approved by Architect/Engineer.
 - 2. Equipment includes, but is not limited to, air handling units, fan coil units, variable volume boxes, fans, pumps, boilers and chillers.
 - 3. Submit schedule of equipment to be included and designations.
- B. Provide nameplates with 1/2" high letters and fastened with epoxy or screws.

3.7 OBSTRUCTIONS

- A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
 - 1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
 - 2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
- B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.8 PROTECTION

- A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

3.9 INDOOR AIR QUALITY

- A. All equipment and ductwork shall be installed to allow sufficient space for testing, maintenance, and commissioning functions. Access doors or panels shall be installed in ventilation equipment, ductwork, and plenum enclosures for inspection and cleaning of outdoor air intakes, mixing plenums, up and downstream of coils, filters, drain pans and fans.
- B. Practice source control and eliminate potential contaminants in material selection, installation, and maintenance.
- C. Provide installation and disposal instructions for all materials and chemicals that are potential contaminants.
- D. Obtain and conform to the requirements of the Material Safety Data Sheets (MSDSs) in the use of materials.
- E. Utilize manufacturer's recommendations and provide installation instructions for all chemicals, compounds, and potential contaminants including pre-installation degassing if required.
- F. Ventilate completed building prior to final completion using no less than design outside air

- for at least 48 hours before occupancy.
- G. Make provisions for controls to prevent the entry of air contaminants into the HVAC air distribution system.
- H. Steps shall be taken to ensure that the HVAC system continues to function effectively and are not damaged or contaminated during construction activities.

END OF SECTION

SECTION 23 0510
HVAC CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.2 QUALITY CONTROL PROGRAM

- A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes to match approved samples. All exposed finishes shall be approved by the Architect. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide qualified personnel to observe:
 - 1. Field conditions.
 - 2. Condition of installation.
 - 3. Quality of workmanship.
 - 4. Start-up of equipment.
 - 5. Testing, adjusting, and balancing of equipment.
- B. Representative shall make written report of observations and recommendations to Architect / Engineer.

1.7 MOCK-UPS

- A. Assemble and erect the specified equipment and products complete, with specified anchorage and support devices, seals and finishes.
- B. Do not proceed with any work involving a mock-up, until the related mock-up has been approved in writing.
- C. Acceptable mock-ups in place shall be retained in the completed work.
- D. Perform tests and submit results as specified.

1.8 SCHEDULING OF MOCK-UPS

- A. Schedule demonstration and observation of mock-ups, in phases, with Architect /

Engineer.

1. Rough-in.
2. Finish with all appurtenances in place.
3. Insulation installed.
4. Demonstrations.

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.

PART 3 - EXECUTION

3.1 AIR HANDLING UNIT

- A. Mock-up an air handling unit, completely installed, including:
 1. Piping connections; including thermowells, test stations, test wells and other piping appurtenances.
 2. Pipe insulation.
 3. Condensate drain piping.
 4. Electrical connections.
 5. Ductwork beyond the first transition.
 6. Control valves and bypass.
 7. Cabinet/internal vibration isolation.
 8. Block valves and balancing valves.
 9. Duct insulation.
 10. Instrumentation.
- B. Tests: Air flow at scheduled static pressure.
- C. Demonstrate:
 1. Filter accessibility.
 2. Accessibility to drain and components for service.
 3. Controls sequence.

3.2 DUAL DUCT TERMINAL BOX

- A. Mock-up a Dual Duct Terminal Box completely installed, including:
 1. Electrical connections.
 2. Duct connection beyond first transition.
 3. Cabinet/internal vibration isolation.
 4. Suspension system.
- B. Tests: Air flow at scheduled static pressure.
- C. Demonstrate:
 1. Control Sequence.
 2. Accessibility to components for service.

3.3 HOT AND CHILLED WATER CIRCULATING PUMPS

- A. Mock-up one each system pump, completely installed including:
 1. Pump mounted on housekeeping pad.
 2. Auxiliary drain pan. (Chilled water only)
 3. Piping to a point beyond the complete valve and instrumentation assemblies.
 4. Strainers with blowdown.
 5. Flexible piping connection.
 6. Pipe supports.
 7. Pipe insulation.
 8. Pump painting.
 9. Electrical connections.

3.4 PROTECTION OF EQUIPMENT

- A. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the Contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.
- B. Adequately protect equipment from damage after delivery to the project. Cover with heavy tarpaulins, drop cloths or other protective coverings as required to protect from plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion.

END OF SECTION

**SECTION 23 0511
MECHANICAL ALTERATIONS PROJECT PROCEDURES**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Inspect and service existing equipment and materials that are to remain or to be reused.
- B. Disposal of equipment, materials, or housekeeping pads to be abandoned. Prior to disposal, the Contractor shall verify with the Owner what is to be salvaged by the Owner and what is to become the property of the Contractor.
- C. Handling of equipment and materials to be removed.

1.2 QUALITY ASSURANCE

- A. Coordination with the Owner prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.3 CONTRACT DRAWINGS

- A. There is the possibility that existing conditions and devices are affected by the work indicated on the drawings and called for in the specifications (project manual) which do not appear on the drawings. It is the Contractor's responsibility to visit the site and determine all of the existing conditions and to consider these existing conditions when making and presenting a proposal, to have a complete proposal.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Material used to upgrade and repair existing equipment shall conform to that specified.
- B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.
- C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer's approved distribution channels, shall have manufacturer's warranties for the new material being used, and shall be listed for the use intended.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Contractor shall notify the Architect / Engineer, in writing, accordingly.
- B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect / Engineer, in writing.
- C. Verify field measurements, above and underground piping connections and flows.
- D. Demolition Drawings are based on casual field observation, and when available, existing record documents. Report discrepancies to Architect before disturbing existing installation, and immediately after such discrepancies are discovered.
- E. Field verify existing conditions and actual utility uses prior to final connections. Existing drawings may not have been available for all required information. Use pipe inspection camera system to field verify existing sanitary / grease waste connections. Verify actual HVAC supply and return piping connections. Verify flow direction and depth prior to connection to existing plumbing systems.

3.2 APPLICATION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be cleaned and reconditioned, including cleaning of piping systems and HVAC coils prior to installation and reuse.
- B. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and be removed from the site.
- C. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner or the Architect / Engineer. Relocate material and / or equipment as directed by Owner.
- D. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.
- E. Materials, equipment and housekeeping pads not to be reused or reconnected shall be removed for Owner's review and salvaged by Contractor.
- F. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner's use.
- G. Clean and repair existing materials and equipment that remain or are to be reused.
- H. Contractor shall utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

3.3 SEQUENCE AND SCHEDULE

- A. Coordinate utility service outages with Utility Company, Architect and Owner.
- B. Provide additional or temporary valves, piping, ductwork and connections to maintain existing systems in service during construction.
- C. Existing HVAC and Plumbing Service: Refer to drawings for work in remodeled areas. Where facilities in these areas are to remain in service, any related work to keep the facilities in operation is specified in this Division. Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Maintain acceptable temperature and humidity control within existing building during renovation activities.
- D. Remove and replace existing Mechanical systems and appurtenances as occasioned by new or remodeled construction. Re-establish service that may be interrupted by remodeled construction.
- E. Refer to other drawings series for work in remodeled areas. Where facilities in these areas are required to remain in service, any related work required to keep these facilities in operation is specified in this Division.
- F. Remove and replace existing piping, grilles, boxes and ductwork coincident with the construction.
- G. Remove or relocate existing piping, grilles, ductwork or housekeeping pads as occasioned by new or remodeled construction. Cap unused HVAC or domestic piping and duct beyond the new finish line.
- H. Relocate all HVAC and or domestic piping, grilles, boxes and ductwork as required to accommodate new work requiring precedence.
- I. Remove concrete housekeeping pad where materials or equipment have been removed.
- J. Remove all known utilities, which do not provide service to the buildings that remain.
- K. Remove existing plumbing or mechanical vent penetrations through roof not to be reused.

3.4 DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

- A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination as directed by the Owner's representative unless they are not wanted, then it will be the responsibility of this Contractor to remove such items and properly dispose of them. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion, and upon approval of the Owner's representative substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.
 - B. All items to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean, repair, and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore them to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.
 - C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner's representative to such items and receive further instructions before removal. Items damaged in repositioning operations are the contractor's responsibility and shall be repaired or replaced by the contractor as approved by the owner's representative, at no additional cost to the Owner.
 - D. HVAC, Plumbing, piping, ductwork and appurtenances to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner's representative. Piping and ductwork not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Construction Inspector. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities that must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner's representative hereinbefore specified.
 - E. Repair adjacent construction and finishes damaged during demolition and extension work.
 - F. Maintain access to mechanical installations that remain active. Modify installation or provide access panel as appropriate.
 - G. Extend existing installations using materials and methods compatible with existing mechanical installations, or as specified.
 - H. Existing mechanical piping and devices found to need additional hangers installed should be added at no additional cost to the Owner.
- 3.5 PROTECTION OF THE WORK**
- A. Provide adequate temporary support and auxiliary structure as necessary to ensure structural value or integrity of affected portion of work.
 - B. Provide devices and methods to protect other portions of work from damage.
 - C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.
- 3.6 IDENTIFICATION OF EQUIPMENT IN RENOVATED AREAS**
- A. Identification of Equipment: Provide new identification of all existing equipment to be reused and located within the renovated areas. Do not include the description
-

“existing”. Provide new nameplates for all existing mechanical equipment in renovated areas as specified in Section 23 05 00 Mechanical General Provisions.

3.7 REFRIGERANT DISPOSAL

- A. Contractor shall dispose of refrigerant from all DX equipment including refrigerant piping per OSHA, EPA, Federal, State and Local Codes.

END OF SECTION

SECTION 23 0512
SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Prepare submittals as required by these specifications as outlined below.
- B. The term submittal, as used herein, refers to all:
 - 1. Shop Drawings
 - 2. Coordination Drawings
 - 3. Product data
- C. Submittals shall be prepared and produced for:
 - 1. Distribution as specified
 - 2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

- A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
- B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.
- C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.
- D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

1.3 COORDINATION DRAWINGS

- A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: $\frac{1}{4}'' = 1'-0''$.
- B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
- C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
 - 1. Actual mechanical equipment and components to be furnished
 - 2. Service clearance
 - 3. Relationship to other equipment and components
 - 4. Roof drains and leader piping
 - 5. Fire protection piping and equipment
- D. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- E. Related requirements:
 - 1. Ductwork shop drawings
 - 2. Coordination drawing specified in Division 26
- F. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.
- G. Gas piping sketch indicating proposed location of piping prior to proceeding with the installation.

1.4 PRODUCT DATA AND INSTALLATION INSTRUCTION

- A. Submit only pages which are pertinent to the project. All options which are indicated on the product data shall become part of the contract and shall be required whether specified are not.

- B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.
- C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.
- D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
- E. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: COMPLY, DO NOT COMPLY, or NOT APPLICABLE. Explain all DO NOT COMPLY statements.
- F. Provide a separate transmittal for each submittal item. Transmittals shall indicate product by specification section name and number. Separate all submittals into appropriate specification section number. Do not combine specification sections.

1.5 MANUFACTURERS INSTRUCTIONS

- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

1.6 CONTRACTOR RESPONSIBILITIES

- A. Review submittals prior to transmittal.
- B. Determine and verify:
 - 1. Field measurements
 - 2. Field construction criteria
 - 3. Manufacturer's catalog numbers
 - 4. Conformance with requirements of Contract Documents
- C. Coordinate submittals with requirements of the work and of the Contract Documents.
- D. Notify the Architect/Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
- E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.
- F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.
- G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect/Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.
- H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
 - 1. Proper sizes and capacities
 - 2. That the item will fit in the available space in a manner that will allow proper service
 - 3. Construction methods, materials and finishes
- I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.7 SUBMISSION REQUIREMENTS

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.
- B. Number of submittals required:
 - 1. Shop Drawings and Coordination Drawings: Submit one reproducible transparency and three opaque reproductions.
 - 2. Product Data: Submit the number of copies which the contractor requires, plus

- those which will be retained by the Architect/Engineer.
- C. Accompany submittals with transmittal letter, in duplicate, containing:
 - 1. Date
 - 2. Project title and number
 - 3. Contractor's name, address and contact number.
 - 4. The number of each Shop Drawing, Project Datum and Sample submitted
 - 5. Other pertinent data
 - D. Submittals shall include:
 - 1. The date of submission
 - 2. The project title and number
 - 3. Contract Identification
 - 4. The names of:
 - a. Contractor
 - b. Subcontractor
 - c. Supplier
 - d. Manufacturer
 - 5. Identification of the product
 - 6. Field dimensions, clearly identified as such
 - 7. Relation to adjacent or critical features of the work or materials
 - 8. Applicable standards, such as ASTM or federal specifications numbers
 - 9. Identification of deviations from contract documents
 - 10. Suitable blank space for General Contractor and Architect/Engineer stamps
 - 11. Contractor's signed and dated Stamp of Approval
 - E. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
 - 1. Finishes which involve Architect/Engineer selection of colors, textures or patterns
 - 2. Associated items which require correlation for efficient function or for installation

1.8 SUBMITTAL SPECIFICATION INFORMATION

- A. Every submittal document shall bear the following information as used in the project manual:
 - 1. The related specification section number
 - 2. The exact specification section title
- B. Submittals delivered to the Architect/Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.9 RESUBMISSION REQUIREMENTS

- A. Make re-submittals under procedures specified for initial submittals.
 - 1. Indicate that the document or sample is a re-submittal
 - 2. Identify changes made since previous submittals
- B. Indicate any changes which have been made, other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

- A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
- B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect/Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

- C. Do not deliver any submittals to the Architect/Engineer that do not bear the Contractor's stamp of approval and signature.
- D. Submittals delivered to the Architect/Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

- A. The Architect / Engineer will:
 - 1. Review identified submittals with reasonable promptness and in accordance with schedule
 - 2. Affix stamp and initials or signature, and indicate requirements for re-submittal or approval of submittal
 - 3. Return submittals to Contractor for distribution or for resubmission
- B. Review and approval of submittals will not extend to design data reflected in submittals which is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.
- C. Architect / Engineer's review and approval is only for conformance with the design concept of the project and for compliance with the information given in the contract.
 - 1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
 - 2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.
- D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

- A. Do not make requests for substitution employing the procedures of this Section.
- B. The procedure for making a formal request for substitution is specified in Div. 1.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

**SECTION 23 0513
ELECTRICAL PROVISIONS OF HVAC WORK**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Electrical provisions to be provided as mechanical work are indicated in other Division 23 sections, on drawings, and as specified.
- B. Types of work, normally recognized as electrical but provided as mechanical, specified or partially specified in this Section, include but are not necessarily limited to the following:
 - 1. Motors for mechanical equipment.
 - 2. Starters for motors of mechanical equipment, but only where specifically indicated to be furnished integrally with equipment.
 - 3. Wiring from motors to disconnect switches or junction boxes for motors of mechanical equipment, but only where specifically indicated to be furnished integrally with equipment.
 - 4. Wiring of field-mounted float control switches, flow control switches, and similar mechanical-electrical devices provided for mechanical systems, to equipment control panels.
 - 5. Wiring of smoke detectors for shutdown of air handling equipment when a fire alarm system is not included in the project.
 - 6. Wiring of oil pump, vibration and oil level limit switches for cooling towers.
 - 7. Refrigerant monitor/sensor/alarming and field installed visual/audible display alarms.
 - 8. Pipe heat tracing.
 - 9. Cooling tower vibration switch/interlock/reset.
 - 10. Field interlock wiring from chiller: flow switches, pump aux. Contacts, pump start/stop.
 - 11. Power supply 120 VAC and control signal from chiller control panel to condenser water flow control valve installed in piping leaving chiller.
 - 12. Wiring of all related circulating water system chemical treatment devices.
 - a. Low voltage electric contacting water meter
 - b. Solenoid valve/blow-down assembly
 - 13. Radiant heater timer switches and/or thermostats
 - 14. Low Voltage thermostat wiring
 - 15. Wiring for pump motor internal heaters
- C. Refer to Division 23 Controls Sections for related control system wiring.
- D. Refer to Division 23 sections for specific individual mechanical equipment electrical requirements.
- E. Refer to Division 26 sections for motor starters and controls not furnished integrally with mechanical equipment.
- F. Refer to Division 26 sections for junction boxes and disconnect switches required for motors and other electrical units of mechanical equipment.

1.2 RELATED WORK

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to work of this Section.

1.3 QUALITY ASSURANCE

- A. Wherever possible, match elements of electrical provisions of mechanical work with similar elements of electrical work specified in Division 26 sections for electrical work not otherwise specified.
- B. For electrical equipment and products, comply with applicable NEMA standards, and

refer to NEMA standards for definitions of terminology. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.4 SUBMITTALS

- A. Include in listing of motors, voltage, notation of whether motor starter is furnished or installed integrally with motor or equipment containing motors.

PART 2 - PRODUCTS

2.1 MOTORS

- A. Provide motors for mechanical equipment manufactured by one of the following:
 - 1. Baldor Electric Company.
 - 2. Century Electric Div., Inc.
 - 3. General Electric Co.
 - 4. Louis Allis Div.; Litton Industrial Products, Inc.
 - 5. Lincoln Electric
 - 6. Marathon Electric Mfg. Corp.
 - 7. Reliance Electric Co.
 - 8. Westinghouse Electric Corp.
 - 9. WEG
 - 10. U.S. Motors
- B. Motor Characteristics. Except where more stringent requirements are indicated, and except where required items of mechanical equipment cannot be obtained with fully complying motors, comply with the following requirements for motors of mechanical work:
- C. Temperature Rating. Rated for 40 Degrees C environment with maximum 50 Degrees C temperature rise for continuous duty at full load (Class A Insulation).
- D. Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than 5 starts per hour for manually controlled motors.
- E. Phases and Current Characteristics. Provide squirrel-cage induction polyphase motors for 3/4hp and larger, and provide capacitor-start single-phase motors for 1/2hp and smaller, except 1/6hp and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division 26 sections, and with individual equipment requirements specified in other Division 23 requirements. For 2-speed motors provide 2 separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.
- F. Service Factor. 1.15 for polyphase motors and 1.35 for single-phase motors.
- G. Motor Construction. Provide general purpose, premium efficiency motors, continuous duty motors, Design "B" except "C" where required for high starting torque.
 - 1. Frames. NEMA #56.
 - 2. Bearings are to be ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual section of Division 23 for fractional-hp light-duty motors where sleeve-type bearings are permitted.
 - 3. Except as indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded drip-proof motors where exposed to contact by employees or building occupants. Provide weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division 23 for other enclosure requirements.
 - 4. Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
 - 5. Noise Rating: Provide "Quiet" rating on motors.

- H. All motors shall be premium efficiency.
- I. Provide an inverter duty motor on all equipment that utilizes a variable frequency drive.
- J. Provide TEFC or TEAO motors on all Air Handling Units, Pumps, Supply Fans, Cooling Towers and Fan Coil Units with motors larger than 1 HP.

2.2 EQUIPMENT FABRICATION

- A. Fabricate mechanical equipment for secure mounting of motors and other electrical items included in work. Provide either permanent alignment of motors with equipment, or adjustable mountings as applicable for belt drives, gear drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives. Arrange for lubrication and similar running-maintenance without removal of guards.

2.3 GENERAL REQUIREMENTS – SHAFT GROUNDING RINGS

- A. All motors operated on variable frequency drives shall be equipped with a maintenance-free, conductive microfiber shaft grounding ring to meet NEMA MG-1, 3.4.4.4.3 requirements, with a minimum of two rows of circumferential microfibers to discharge damaging shaft voltages away from the bearings to ground. SGR's Service Life: Designed to last for service life of motor. Provide AEGIS SGR Conductive MicroFiber Shaft Grounding Ring, or approved equal.
- B. Application Note: Motors up to 100 HP shall be provided with one shaft ground ring installed on either the drive end or non-drive end. Motors over 100 HP shall be provided with an insulated bearing on the non-drive end and a shaft grounding ring on the drive end of the motor with the exception of line contact bearings in the drive end of the machine. In this instance the line contact bearing must be electrically insulated and the AEGIS Bearing Protection Ring installed on the opposite drive end of the motor. Grounding rings shall be provided and installed by the motor manufacturer's recommendations.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, anchored to resist torque, drive thrusts, and other external forces inherent in mechanical work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.
- B. Verify voltage with Electrical Plans.
- C. Install all electrical and control conduit into the bottom only of all electrical enclosures for motors, VFD cabinets, control cabinets, chillers, etc. (No top or side cabinet penetrations) Top of electrical enclosure must be kept water tight. Top or side cabinet penetrations will not be accepted inside or outside of the building.
- D. Motor Connections: For motors 10 HP and larger, at the motor connection do not use wire nuts. Provide listed insulated multitap connectors or provide copper alloy split bolt connection, or compression lugs and bolts: insulate connection with Scotch Super 88 vinyl electrical tape over rubber tape.

END OF SECTION

SECTION 23 0514
HVAC CONDENSATE DRAIN PIPING SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide and install air conditioning condensate drains.

1.2 RELATED WORK

- A. Division 23 – Mechanical:
 - 1. Insulation
 - 2. Fan/Coil Units
 - 3. Air Handling Units
 - 4. Chilled Water Pumps
 - 5. Air Compressor Storage Tanks
 - 6. Equipment Drain Pans

PART 2 - PRODUCTS

2.1 PIPE MATERIAL

- A. Type "L" copper with drainage pattern fittings.
- B. For Air Handling Units – Schedule 40 Galvanized Steel Pipe.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install the system to facilitate easy removal.
 - 1. Use threaded plugged tee at each change of direction to permit cleaning.
 - 2. Install a cleanout every 50 feet of straight run piping
 - 3. Maintain a positive slope on all piping
- B. Install a water seal trap leg based on the fan pressure.
 - 1. Size the length of the trap leg 1 inch larger than the actual system pressure.
- C. Install traps and cleanout as shown in the drawing details.
 - 1. Confirm requirements with manufacturer's installation instructions

3.2 SIZE PIPE AS SHOWN ON DRAWINGS.

- A. Do not install piping sized smaller than the unit drain connection size.

3.3 SECONDARY DRAINS

- A. Provide secondary drains where required by code, shown on the drawings, or where equipment has secondary drain connections.
- B. Provide secondary drain line to approved location whenever possible.

END OF SECTION

**SECTION 23 0517
HVAC ACCESS DOORS**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install access doors in wall or ceiling locations as required or shown for access to valves, controls, fire dampers, air distribution devices and other equipment requiring maintenance, adjustment or operation.

PART 2 - PRODUCTS

2.1 NON-FIRE RATED ACCESS DOORS

- A. 16-Gauge frames
- B. 14-gauge steel panels
- C. Continuous fully concealed hinges
- D. Flush screwdriver cam lock & cylinder lock for Owner selection
- E. Automatic closing and latching mechanism
- F. Prime coat finish
- G. Brushed satin stainless steel finish for restroom, kitchen or cafeteria installation
- H. Material suitable for wall and/or ceiling mounting

2.2 FIRE RATED ACCESS DOORS

- A. UL listed, 1-1/2 hour Label "B", access doors
- B. 16-Gauge stainless steel
- C. 20-Gauge insulated sandwich-type door panel.
- D. Two inch thick with fire rated insulation
- E. Continuous fully concealed hinge
- F. Automatic closing and latching mechanism
- G. Knurled knob and recessed key operation for Owner selection
- H. Interior latch release slide for opening from inside
- I. Prime coat finish
- J. Material suitable for wall and/or ceiling mounting

2.3 ACCEPTABLE MANUFACTURERS

- A. Milcor
- B. MIFAB
- C. Acudor
- D. Elmdor

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Access doors specified in Division 23 will be installed by other crafts. Not all required access doors are shown. Coordinate with the Contractor to locate access doors for ease of operation and maintenance of concealed equipment.
- B. Installation shall be in accordance with the manufacturer's printed instructions.
- C. Minimum size required:
 - 1. 36" x 24" for Mechanical HVAC equipment related items
 - 2. 18" x 18" for electrical related items
 - 3. 12" x 12" minimum for Fire and Smoke dampers

END OF SECTION

SECTION 23 0518
VARIABLE FREQUENCY INVERTER

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install a variable frequency inverter for the following equipment items.
 - 1. Variable Volume Air Handling Units.

1.2 RELATED WORK

- A. Division 23 Mechanical
 - 1. Electrical Provisions of Mechanical Work.
 - 2. Air Handling Units
 - 3. Building Management Control System Sequences

1.3 COOPERATION WITH OTHER TRADES

- A. Coordinate this work with work under Division 26 Electrical to ensure that intended functions are achieved.
- B. Coordinate the size of the variable frequency inverter with the equipment being served by the inverter. The rated current output amps are to be equal to or greater than motor rated full load amps.

1.4 SUBMITTALS

- A. Submit manufacturer's information and shop drawings as specified.
 - 1. Complete technical details.
 - 2. Dimensions and manufacturer's installation manual.
 - 3. Schematic diagrams of the circuitry and field connections.
 - 4. Manufacturer's start-up manual.

1.5 STANDARDS

- A. UL.
- B. CSA.
- C. ISO 9001
- D. NEC
- E. FCC

1.6 WARRANTY

- A. Provide a three year parts and labor warranty from date of Substantial Completion. Provide warranty in writing to Owner and HVAC supervisor with applicable warranty coverage dates.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. ABB
- B. Danfoss Graham
- C. Yaskawa

2.2 CABINET

- A. The inverter and all accessories shall be provided within a wall mounted UL Listed NEMA 1 enclosure in interior AHU mechanical rooms and in NEMA 12 enclosure with deadsides and removeable, gasketed doors with provisions for locking in all Plant locations and pump rooms. Cabinet shall be constructed of metal for reduction of radio frequency interference (RFI) and electromagnetic frequency interference.

2.3 INTERFERENCE WITH OTHER SYSTEMS

- A. The inverter shall be designed and constructed to comply with IEEE Standard 519-1993 with respect to line noise and RFI generation. All units shall generate less than 3% total harmonic distortion back to the incoming power line at the point of common connection with sensitive equipment. A harmonic analysis shall be submitted with the approval drawings to verify compliance with the latest version of IEEE-519 voltage and current distortion limits as shown in Table 1.2 and 10.3 at the point of common coupling (PCC). The PCC shall be defined as the consumer-utility interface or primary side of the main distribution transformer.
- B. Dual DC Bus filtered chokes (factory installed and wired in the drive enclosure) equivalent to 5% input line reactors shall be provided to minimize harmonics reflected onto the input line.
 - 1. Shall not interfere with computer and other electronic systems in the building.
 - 2. If not inherently protected, provide a suitable isolation transformer.
 - 3. The system shall not produce spikes on the incoming line.
- C. Any inverter that generates sufficient electrical line noise to interfere with the operation of sensitive building equipment shall be field modified or replaced by the inverter supplier at no additional cost to the Owner.

2.4 PROTECTIVE CIRCUITS

- A. Provide the following protection:
 - 1. Input line fuses or molded case circuit breaker rated at 100 AIC.
 - 2. Input line noise suppression with MOV's (metal oxide varistors) and snubber circuits. MOV's shall be provided across incoming line terminals, AC input reactors, DC choke filters, and transistors to protect inverter from voltage surges and spikes.
 - 3. Protection of solid state inverter devices by limiting output current to 110% of inverter rating, automatically prevent overcurrent trip due to momentary overload conditions.
 - 4. Current limiting DC buss fuse between input and output sections of inverter.
 - 5. Input overvoltage trip.
 - 6. Input undervoltage (-12%) trip.
 - 7. Instantaneous overcurrent protection of solid state inverter devices.
 - 8. Individual overcurrent protection of solid state inverter devices.
 - 9. Output overvoltage trip.
 - 10. Loss of input phase, phase reversals, or blown fuse.
 - 11. Thermal overload trip for overload protection of solid state devices.
 - 12. Ground fault protection on start-up.
 - 13. Output line to line short circuit protection.
 - 14. Phase to phase short circuit or severe overload conditions of output.
 - 15. Overload of motor.
 - 16. Frequency stall.
 - 17. DC buss high voltage.
 - 18. Control function error.
 - 19. Heatsink over temperature (Max. operating ambient: 122 degrees F)
 - 20. Controller able to operate without a motor or any other equipment connected to the output (To facilitate startup and troubleshooting).
 - 21. Capable of restarting into a rotating motor without component damage.
 - 22. Shut down safely without component failure in the event of a sustained power loss, and will automatically return to normal operation, if start is "on" and power is restored.
 - 23. Shut down safely without component failure in the event of a momentary power loss. Automatically return to normal operation if the start is "on", and normal

- power is restored. Capable of establishing speed control without shutdown or component failure.
24. Designed for input power contactor opening or closing while control is activated, without damage to the controller.
 25. Automatically reset trip resulting from overcurrent, undervoltage, overvoltage, or over temperature, and automatically restart after removal, or correction of the faulty condition.
 26. Provide status lights or digital display for indication of failure conditions, and form C relay provided for remote indication. Digital display or status lights to indicate power on, at speed, and drive enabled.
 27. Operation and fault diagnostic function circuits shall be built into each inverter that provides information in determining the cause and source of a fault.
Diagnostics to provide the following information:
 - a. Operating mode at trip (Accel, Decel, Constant speed).
 - b. Output current at trip.
 - c. Output voltage at trip.
 - d. Additional faults that occurred simultaneously or immediately before displayed tripped.Any drive requiring separate card to provide this information shall provide a diagnostic card for each drive.
 28. DC link reactor.
 29. Input power disconnect, lockable type.
 30. Input power disconnect switch / circuit breaker, with lockable type handle.

2.5 OPERATOR DEVICES

- A. The following operator devices shall be door or remote mounted:
 1. Digital keypad and LCD provided to perform all parameter adjustments, operation monitoring, and operation programming.
 2. Power on indication light.
 3. Flush mounted meters or digital display to indicate output voltage, output frequency, and output current, in percent of maximum 0 to 100%.
 4. Manual/Off/Auto 3 position selector switch (hand-off-auto) and manual speed setting control to provide the following control sequences:
 - a. In automatic mode, controller shall follow an external control signal and respond to remote start-stop contact.
 - b. In manual (hand) mode, controller shall follow speed signal set via door mounted keypad and start/stop switch. Switching from "hand" to "auto" and vice versa shall require a single keystroke to a dedicated changeover key. Inverters requiring multiple keystrokes and/or reprogramming of internal parameters to accomplish changeovers are not acceptable.
 - c. An integral "safety interlock" protection shutdown circuit shall be provided for interface with firestats, smoke detectors, high static pressure limit switches, vibration switches, etc.
 5. Programmable lockout code to prevent unauthorized programming.
 6. Critical frequency avoidance capability (up to 3 resonant points).

2.6 FIELD ADJUSTMENTS

- A. The following shall be adjustable in the field:
 1. Maximum Speed: 0 to 125% adjustable.
 2. Minimum Speed: 0 to 100% adjustable.
 3. Acceleration/deceleration rates: 0 to 3600 sec.
 4. Instantaneous overcurrent trip: 50% to 2000%.

5. Volts/hertz ratio: Field adjustable to 16 patterns or set for automatic selection of proper V/F load profile to operate motor without overdriving or overloading.
6. Current limit circuit: 60 to 100%.
7. Carrier frequency: 6 to 16 KHZ.
8. Control interface: selectable to follow a 0-5 VDC, 0-10 VDC, 4-20 MA, either direct or indirect acting.
9. Control signal Bias: 0 to 80 HZ.
10. Control signal gain: 0 to 80 HZ.
11. Calibration of remote speed signal: 0 to 80 HZ.

2.7 ELECTRICAL CONSTANT SPEED BYPASS

- A. Provide all components and circuitry necessary to provide manual bypass of the inverter. The bypass package shall be mounted in a cabinet common with the inverter and shall be constructed in such a manner that the inverter can be removed for repair while still operating the motor in the "bypass" mode. Manual bypass shall contain the following:
1. Two contactors mechanically interlocked via a three position through the door selector switch to provide the following control:
 - a. "Inverter" Mode connects the motor to the output of the inverter.
 - b. "Bypass" Mode connects the motor to the input sine wave power. Transfer must occur with input disconnect open. Motor is protected via thermal overload.
 - c. "Off" Mode disconnects motor from all input power.
 2. A molded case circuit breaker or fused disconnect switch with door interlocked handle (lock out type) that interrupts input power to both the bypass circuitry and the drive.
 3. An input contactor, interlocked with both the thermal motor overload and external safeties which disconnects power to the motor regardless of the mode of operation (either "inverter" or "bypass" mode).
 4. A thermal overload to provide protection of motor in the bypass mode.
 5. A safety interlock circuit that disconnects power to the motor (regardless of the mode of operation – "inverter" or "bypass") in response to a signal from the thermal overload and/or external safety circuits.
 6. Line voltage to 24 volt DC power source, fused per NEC, shall provide power to all bypass control circuits.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation as per manufacturer's recommendations and requirements.
1. Inverter chassis is properly grounded.
 2. Line, Load, Control, and Fire/Safety wiring are installed in separate conduits.
 3. Length of wire between Motor and Variable frequency drive shall not exceed 100 feet.
 4. Install all electrical and control conduit into the bottom only of VFD cabinet. (No top or side cabinet penetrations)

3.2 MANUFACTURER START-UP SERVICE

- A. Factory trained personnel shall be provided for start-up assistance, minimum (1) day per unit.
1. The manufacturer shall provide start-up commissioning of the VFD and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. Sales personnel and other agents who are not factory certified shall not be acceptable as commissioning agents.
 2. Start-up services shall include checking for verification of proper operation and

- installation for the VFD, its options and its interface wiring to the building automation system.
 - 3. Adjustable devices, components, and assemblies to assure optimum performance.
 - 4. Make final adjustments to the installed drive to assure proper operation of the fan system. Obtain performance requirements from installer of driven loads.
 - 5. Assistance will be provided to the Owner (upon request) to determine the optimum capacitance for per factory correction and avoidance of potential resonance problems and will determine optimum line filter required.
 - 6. A written report, duly signed by the technician detailing set points of adjustable devices, amperages recorded, and any other pertinent data. This information is to be included in the operation and maintenance manual.
- B. Input DC voltage to dry motor windings when motor is not in operation at all locations.

3.3 DEMONSTRATION AND TRAINING

- A. Provide system demonstration to personnel, Owner, and/or Owner's selected representatives. Provide training plan in writing to owner.
- B. Demonstrate operation of controllers in the automatic and manual modes.
- C. Provide a minimum of two days of technical training for the owner's operating and technical staff. Schedule training with Owner's authorized representatives, during normal business hours and not less than 30 days prior to planned session.
- D. Training may be consecutive or random, at Owner's option.

END OF SECTION

SECTION 23 0519
HVAC PRESSURE AND TEMPERATURE INSTRUMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This section specifies gauges, thermometers, wells and/or pressure and temperature test stations to be installed as specified.

1.2 RELATED WORK

- A. Division 23, Mechanical
 - 1. 23 05 00 - Mechanical General Provisions
 - 2. 23 20 00 - Pipe and Pipe Fittings, General
 - 3. 23 05 23 - Valves, Strainers and Vents
 - 4. 23 21 13 - Hot Water and Chilled Water Piping, Valves and Appurtenances

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - GAUGES AND THERMOMETERS

- A. Trerice
- B. Taylor
- C. Marsh
- D. Weksler
- E. Marshalltown
- F. Weiss
- G. Miljoco

2.2 PRESSURE GAUGES

- A. Case and Ring: 4" type 304 stainless steel; liquid filled case with stainless steel bayonet ring.
- B. Dial: White aluminum with black markings
- C. Window: Clear acrylic
- D. Tube: Phosphor bronze and forged brass socket.
- E. Gauge accuracy: +/- 1% over operating range.
- F. For pulsating service, provide impulse dampers.
- G. Without flange for pipe mounting.
- H. With flange for wall mounting.
- I. Weiss Model: LF44S-1B or equal.

2.3 THERMOMETER WELLS

- A. Brass or type 300 stainless steel. Machined bar stock, 1-piece construction.
- B. Where installed in insulated piping or vessels, provide with extension neck to match insulation thickness.
- C. Provide metal-to-metal contact with bulb chamber for maximum sensitivity.
- D. Wells shall be sized to extend a minimum of 50% into pipe.

2.4 THERMOMETERS IN PIPING SYSTEMS OR VESSELS

- A. Die cast aluminum case with baked epoxy finish.
- B. Adjustable angle 9" scale length.
- C. Clear acrylic window.
- D. Brass stem, length to match well.
- E. Red reading organic spirit filled-in magnifying glass column.
- F. White background with black figures and markings.
- G. Brass stems and union connections.
- H. Accuracy: +/- 1% of scale range.

- I. Range:
 - 1. Hot water lines: 30°F to 240°F.
 - 2. Chilled water lines: 0°F to 100°F or 120°F

2.5 PRESSURE AND TEMPERATURE TEST STATIONS

- A. "Test Station" fitting to receive either a temperature or pressure probe. Fitting shall be solid brass with two valve cores of Nordel.
 - 1. Fitted with a color coded cap strap with gasket.
 - 2. Acceptable Manufacturer: Peterson Equipment Company.
 - 3. Provide with extension neck to match insulation thickness.
- B. Provide to the Owner a fitted case with:
 - 1. Two 0-100 psi pressure gauges as specified and adapters with 1/8" OD probe.
 - 2. Four 5" stem pocket testing thermometers.
 - a. Two with range 25°F to 125°F for chilled water and condenser water.
 - b. Two with range 0°F to 220°F for hot water.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with drawing details and manufacturer's recommendations.
- B. Provide a ball valve at each gauge.
- C. Locate gauges and thermometers to be easily readable from the floor at a 5'-6" eye level. Use adjustable angle or rigid stem as required. Install gauges in upright position.
- D. Install gauges in the following locations: across pumps, chiller cooler and condenser, storage tanks, heat exchangers.
- E. Test wells for automatic temperature controls shall be furnished by Building Management Control Section and installed by Mechanical Contractor.
- F. Install thermometer in the following locations: Across chiller cooler and condenser, storage tanks, across heat exchangers, across boiler, leaving side of water heater, leaving water side of tempered water valves, common chilled and hot water lines.
 - 1. Hot water lines: 30°F to 240°F.
 - 2. Chilled water lines: 0°F to 100°F or 120°F

END OF SECTION

SECTION 23 0523
HVAC VALVES, STRAINERS AND VENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. HVAC Valves
- B. Pipe strainer and suction diffusers.

PART 2 - PRODUCTS

2.1 VALVES

- A. Pressure Ratings:
 - 1. Unless otherwise indicated, use valves suitable for 125 minimum psig working steam pressure (WSP) and 450°F.
 - 2. The pressure temperature rating of valves shall be not less than the design criteria applicable to components of the system.
- B. Butterfly Valves
 - 1. Butterfly valves shall conform to MSS-SP67.
 - 2. Liners, inserts and discs shall be suitable for the intended service.
 - 3. Valves shall have a full lug type body designed for installation between ANSI standard flanges, and shall be rated at full working pressure with downstream flange removed.
- C. Balancing Valves
 - 1. Provide balancing valves with:
 - a. Corrosion resistant plug with resilient seal when required.
 - b. O-ring stem seal.
 - c. Permanently lubricated, corrosion resistant bearings.
 - 2. Connections
 - a. Through 2" pipe size use threaded connections.
 - b. For valves 2-1/2" pipe size and larger shall be provided with 150 psig flange connections.
 - 3. Provide each valve with:
 - a. Memory stop.
 - b. Plastic drip cap.
 - c. 1/8" gauge tap.
- D. Ball Valves
 - 1. Provide ball valves with:
 - a. Blowout proof stem.
 - b. Full size port, 316 stainless steel ball and stem.
 - c. Cast bronze body.
 - d. Threaded ends.
 - 2. Seat, seals, thrust washers and packing shall be suitable for the intended service.
 - 3. Service rating:
 - a. 150 psi saturated steam.
 - b. 600 psi WOG.
 - 4. Where piping is insulated, ball valves shall be equipped with 2" extended handles of non-thermal conductive material. Provide a protective sleeve that allows operation of the valve without breaking the vapor seal or disturbing the insulation.
 - 5. Provide with memory stop for balancing valves.
- E. Valve Connections
 - 1. Provide valves suitable to connect to adjoining piping as specified for pipe joints. Use pipe size valves. Sweated joints are not allowed.
 - 2. Thread pipe sizes 2" and smaller.
 - 3. Flange pipe sizes 2-1/2" and larger.

4. Use screw to solder adapters for copper tubing.
5. Use grooved body valves with mechanical grooved jointed piping.
- F. Valve Operators
 1. Where butterfly valves are provided:
 - a. Provide gear operators on valves 6" and larger.
 - b. Where valves are located 7' or more above the finished floor in equipment room areas provide chain-operated sheaves. Extend chains to about 5' above floor and hook to clips, arrange to clear walking space.
 - c. Lever lock handle with toothed plate for shut-off service and infinitely adjustable handle with lock and nut and memory stop for throttling service on valves 4" and smaller.
 - d. Provide worm gear operators on discharge side of pumps for balancing, for all sizes of valves.
 - e. All valves 2-1/2" and larger provided by Milwaukee Valve shall be provided with gear operators.
- G. Acceptable Manufacturers
 1. Dezurik
 2. Crane
 3. Nibco
 4. Keystone
 5. Kitz (Hot Water Only)
 6. Milwaukee Valve
 7. Keckley
- H. Check Valves
 1. Bronze body, 2" and smaller, bronze disc (Teflon disc for steam service), regrinding swing check, screw-in cap, threaded connection.
 2. Iron body, 2-1/2" and larger, bronze trim, non-slam: stainless steel pins and springs, and bronze plate or bronze mounted, regrind-renew check, bronze seat ring and disc. Provide either wafer or threaded lug.
 3. Acceptable Manufacturers
 - a. Mission Duocheck
 - b. Nibco
 - c. Keystone
 - d. Milwaukee Valve
 - e. Keckley
- K. Provide valves of same manufacturer throughout where possible.
- L. Provide valves with manufacturer's name and manufacturing location, duty and pressure rating clearly marked on outside of body.
- M. Where valves are installed in insulated piping, provide with extended neck so valve operator and stop plate clears the full thickness insulation.
- N. Provide valve, seat and trim materials suitable for the intended service.
- O. Provide memory stops for all valves used for throttling service. Valves for throttling service shall be butterfly, plug, caged or ball type.

2.2 PIPE SYSTEMS STRAINERS

- A. Body:
 1. "Y" pattern or basket as shown on the drawings.
 2. Line size.
 3. Threaded strainer blow down port.
 4. ASTM A #126 Class B Cast Iron Body.
- B. Construction:
 1. 2" size and smaller with screw connections rated 400 psi WOG.
 2. Over 2" size with flanged connections, rated 125 psi WOG.

- C. Fabricate screens of Monel or type 304 stainless steel:
 - 1. With 20 mesh woven wire in piping systems through 2".
 - 2. With 0.045 perforations in piping systems 2-1/2" and 3".
 - 3. With 0.125 perforations in piping systems 4" and larger.
- D. Start-up:
 - 1. Provide an additional fine mesh disposable screen for use during start-up operations.
 - 2. Remove after 30 days.
 - 3. Attach to piping for owners review.
- E. Acceptable Manufacturers
 - 1. Crane
 - 2. Zurn
 - 3. Mueller
 - 4. Armstrong
 - 5. Bell & Gossett
 - 6. Keckley

2.3 SUCTION DIFFUSER

- A. For each pump as shown on the drawing, provide an angle type suction diffuser. Body is to fit both the pump inlet and suction pipe size.
- B. Components:
 - 1. Inlet straightening vanes.
 - 2. Removable end cap.
 - 3. Gauge ports.
 - 4. Threaded strainer blow down port.
 - 5. Adjustable support foot.
 - 6. Removable magnetic insert.
- C. The screen shall be as specified for pipe system strainers.
- D. Provide an additional fine mesh disposable strainer for use during start up operations.
 - 1. Remove after 30 days operation and all flushing is complete.
 - 2. Attach to piping for owners review.
- E. Construction:
 - 1. 2" size and smaller with screw connections rated 400 psi WOG.
 - 2. Over 2" size with flanged connections, rated 125 psi WOG.
- F. Fabricate screens of Monel or type 304 stainless steel:
 - 1. With 20 mesh woven wire in piping systems through 2".
 - 2. With 0.045 perforations in piping systems 2-1/2" and 3".
 - 3. With 0.125 perforations in piping systems 4" and larger.

2.4 VALVE SCHEDULE

- A. Hydronic Service
 - 1. Chilled Water Service
 - a. Ball Valves up to 2": Nibco T-585-70-66 w/Nib-Seal insulated Handle
 - b. Butterfly Valve 2-1/2" and larger: Nibco LD - 2000
Keystone Figure 222
 - 2. Heating & Condenser Water Service
 - a. Ball Valves up to 2": Nibco T-585-70-66
 - b. Butterfly Valve 2-1/2" and larger: Nibco LD - 2000
Keystone Figure 222
 - 3. Check Valve:
 - a. Nibco Check Valve: T - 413 - B
 - b. Nibco Check Valve 2-1/2" and larger: F - 918 - B
 - c. Nibco Check Valve 2-1/2" and larger: W - 920 -W (Wafer)

- d. Keystone Check 2-1/2" and larger: FIQ 810

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install valves with stems upright or horizontal, not inverted.
- B. Install valves for shut-off and isolating service at each piece of equipment, at vertical risers, and where shown on the drawings.
- C. Use butterfly valves and ball valves in circulating water systems, for balancing duty. Provide infinite position gear operator with memory stop.
- D. Provide drain valves at main shut-off valves and low points of piping and apparatus so the systems can be entirely drained.
 - 1. 1" valve for pipes 6" and larger.
 - 2. 3/4" valve for pipes smaller than 6".
 - 3. Terminate with pipe plug.
 - 4. Drain valves shall be ball valves.
- E. Where valves are installed in insulated pipe, valve operator shall have an insert so the lever or handle will not damage the insulation. Install handles so the lever or handles will not damage the insulation.
- F. Provide clearance for installation of insulation and access to valves.
- G. Provide access where valves are not exposed.
- H. Float valves / stilling wells provided and installed in cooling tower or condenser water basins for water level control. Stilling wells provided around float to prevent turbulence ripples or wind from interference.

3.3 PIPE SYSTEMS STRAINERS

- A. Provide an additional fine mesh disposable strainer for use during start up operations.
 - 1. Remove after 30 days operation and all flushing is complete.
 - 2. Attach to piping for owners review.
- B. Provide strainer in supply piping for all coil connections.
- C. Provide strainer in condenser water piping outside near pump and after pump discharge.

3.4 WATER SYSTEM AIR VENTS

- A. Provide manual air vents at high points and at any other air pockets of closed circulating pipe systems. Extend 3/8" hard drawn copper tubing discharge drains to nearest floor or hub drain. Provide 1/4" Ball Valve as specified.
- B. Where high point vents are not readily accessible provide additional valves at vent termination.

END OF SECTION

**SECTION 23 0533
HVAC PIPE HEAT TRACING**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install a complete industrial, constant wattage, UL listed system of electric pipe heat tracing and controls on all make-up water piping outdoors above grade to prevent freezing. The heat tracing system shall conform to ANSI/IEEE Standard 515-1989.
- B. Protect the pipe, valves, fittings, meters and appurtenances. Apply sufficient cable and overheat thermostat to protect the entire system.

1.2 SUBMITTALS

- A. Submit shop drawings and product data as specified in Section 23 05 12
- B. Submit detailed calculations for length of heat tracing cable per foot of pipe, based on actual length of piping installed.
- C. Submit manufacturer's certified capacity charts with selections plotted thereon.
- D. Submit manufacturer's installation instructions.
- E. Submit full load ampere requirement and voltage for branch circuit.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Raychem Corporation
- B. Thermon Manufacturing Company

2.2 COMPONENTS

- A. Self-regulating heater.
 - 1. The self-regulating heater shall consist of two 16 AWG tinned-copper bus wires embedded in parallel in a self-regulating polymer core that varies its power output to respond to temperature all along its length, allowing the heater to be crossed itself without overheating and to be cut in the field. The heater shall be covered by a radiation cross-linked modified polyolefin dielectric jacket.
 - 2. In order to provide energy conservation, and to prevent overheating, the heater shall have a self-regulating factor of at least 90%.
 - 3. The heater shall operate on a line voltage of 120 VAC without the use of transformers.
 - 4. The heater shall be sized according to the following. The required heater output rating is in watts per foot at 50°F (heater selection based on 1-1/2 inch fiberglass insulation on metal piping).
 - 5. The heater shall be XL-Trace as manufactured by Raychem Corporation or XL-Econotrace as manufactured by Thermon Manufacturing Company.
 - 6. Power connection, end seal, splice and tee kits components shall be applied in the field.
 - 7. The system shall be controlled by an ambient sensing thermostat set at 40°F either directly or through an appropriate contactor.
 - 8. Provide an end-of-circuit voltage indicating light

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install and start up the pipe heat tracing system in accordance with the manufacturer's Installation, Start-up and Service Instructions.
- B. Install the pipe heat tracing cable under the pipe insulation.

- C. Apply “Electrically Traced” signs to the outside of the thermal insulation.
- D. Ground fault protection of the equipment shall be provided per the 1996 National Electrical Code, Article 427-22.
- E. Provide a cast aluminum weatherproof NEMA-4 rated junction box for installation of the cable, with pilot light to indicate operation of the cable.
- F. Use only electrical components as recommended by the manufacturer.

3.2 ELECTRICAL WORK

- A. Furnish and install the wire, conduit and raceway systems required for the automatic operation of the pipe heat tracing system. Conform to the National Electrical Code.
- B. The specified wiring work includes:
 - 1. Wiring of control instruments between thermostat and junction boxes
 - 2. Installation of thermostat and junction boxes
 - 3. Wiring from the heat tracing cable to the junction boxes
- C. Related branch circuit power wiring from the junction box to ground fault type circuit is specified to be provided in Division 26.
- D. Provide devices and appurtenances as specified in Division 26.
- E. Identify each circuit at each terminal with a separate tag.
- F. Color code wires in accordance with IPCEA Standards.
- G. Make all joints and connections with approved mechanical connectors.

3.3 TESTING OF THE PIPE HEAT TRACING SYSTEM

- A. Test the pipe heat tracing system:
 - 1. Simulate freezing outside air conditions
 - 2. Measure the amperage draw of the heat tracing system
 - 3. Compare to the manufacturer's capacity rating of the actual system
 - 4. After installation and before and after installing the thermal insulation, subject heat to testing using a 1000 VDC megger. Minimum insulation resistance should be between 20 to 1000 megohms regardless of the length.
- B. Submit records of test for approval prior to substantial completion; insert in the Owner's Manual.

END OF SECTION

**SECTION 23 0548
VIBRATION ISOLATION**

PART 1 - GENERAL

1.1 SCOPE

- A. Furnish, install, and adjust vibration isolation.

1.2 RELATED WORK

- A. Division 23 Mechanical.
1. Refer to the Section on Ductwork for flexible connections between fans and ducts.
 2. Refer to the Section on Equipment Supports for equipment foundation pads.

1.3 SUBMITTALS

- A. Submit product data showing type, size, load, deflection and other information required. Include clearly outlined procedures for installing and adjusting isolators.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Amber Booth
B. Kinetics
C. Mason
D. Korfund
E. VSI.
F. Vibration Eliminator Co., Inc.
G. Metraflex

2.2 ISOLATOR TYPES

- A. Neoprene mountings shall have a minimum static deflection of 0.35 inches (9mm). All metal surfaces shall be neoprene covered and have friction pads both top and bottom. Bolt holes shall be provided on the bottom and a tapped hole and cap screw on top. Steel rails shall be used above the mountings under equipment such as small vent sets to compensate for the overhang.
- B. Hangers shall consist of rigid steel frames containing minimum 1-1/4 inch (32mm) thick neoprene elements at the top and a steel spring with general characteristics as in specification B seated in a steel washer reinforced neoprene cup on the bottom. The neoprene element and the cup shall have neoprene bushings projecting through the steel box. In order to maintain stability the boxes shall not be articulated as clevis hangers nor the neoprene element stacked on top of the spring. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30-degree arc from side to side before contacting the cup bushing and short circuiting the spring. Submittals shall include a hanger drawing showing the 30-degree capability.
- C. Flexible spherical expansion joints shall employ Peroxide cured EPDM in the covers, tubes and frictioning of the reinforcement. Reinforcement must be DuPont Kevlar. Solid steel rings shall be used within the raised face rubber ends to prevent pullout. No substitutions for the DuPont Kevlar or the solid steel embedded flange rings are acceptable. Sizes 2 inch (50mm) and larger shall have two spheres reinforced with a metal ring between spheres to maintain shape and complete with split ductile iron or steel flanges with hooked or similar interlocks. Sizes 16 inch (400mm) to 24 inch (600mm) may be single sphere. Sizes 3/4 inch (20mm) to 1-1/2 inch (40mm) may have threaded bolted flange assemblies, one sphere and cable retention. 14 inch (300mm) and smaller connectors shall be rated at 250 psi (17 BAR) up to 190°F (88°C) with a uniform drop in allowable pressure to 190 psi (13 BAR) at 250°F (121°C). 16 inch (400mm) and larger connectors are rated 180 psi (12 BAR) at 190°F (88°C) and 135 psi (9 BAR) at 250°F (121°C). Safety factors to burst and flange pullout shall be a

minimum of 3/1. All joints must have permanent markings verifying a 5 minute factory test at twice the rated pressure. Concentric reducers to the above specifications may be substituted for equal ended expansion joints.

High pressure joints shall be substituted for the above where operating pressures are higher than standard. Expansion joints shall be installed in piping gaps equal to the length of the expansion joints under pressure. Control rods need only be used in unanchored piping locations where the manufacturer determines the installation exceeds the pressure requirement without control rods. Control rods are not desirable in seismic work. If control rods are used, they must have ½- inch (12mm) thick Neoprene washer bushings large enough in area to take the thrust at 1000 psi (6.9 N/mm⁵) maximum on the washer area. Standard diameter bolt washers are not acceptable.

Submittals shall include two test reports by independent consultants showing minimum reductions of 20 DB in vibration accelerations and 10 DB in sound pressure levels at typical blade passage frequencies on this or a similar product by the same manufacturer. All expansion joints shall be installed on the equipment side of the shut off valves.

Flexible expansion joint device shall be provided with a 5-year warranty against leaks and failure.

2.3 ISOLATOR APPLICATION

EQUIPMENT	ISOLATOR TYPE	MINIMUM DEFLECTION
Cooling Towers	A	0.35"
Condensing Units	A	0.35"
In-Line Fans	B	0.5"

2.4 PIPING ISOLATOR APPLICATIONS

EQUIPMENT	ISOLATOR TYPE
Floor Mounted Pumps	C
Suspended Pumps	C

2.5 FLEXIBLE CONNECTIONS IN PIPING AT PUMPS

- A. Provide flexible connections at suction and discharge of chilled water, and hot water pumps, piping connections on chillers and where indicated on drawings. Refer to schedule above.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Stock Requirements. The isolation manufacturer's representative shall maintain an adequate stock of springs and isolators of type used so that changes required during construction and installation can be made.
- B. Factory Representation. After installation, furnish factory-trained representative of the isolation manufacturer to check various isolators and report measured versus anticipated deflection on all isolators. Have the representative certify that isolators have been installed in accordance with manufacturer's recommendations and approved submittals. Provide written report to Engineer indicating compliance prior to final acceptance.

END OF SECTION

SECTION 23 0593
TESTING, BALANCING AND ADJUSTING (TAB) OF ENVIRONMENTAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Balance, adjust and test the air distribution system including the exhaust system.
- B. Balance, adjust and test the hydronic system.
- C. Verify and record the duct test results performed by the mechanical contractor.

1.2 RELATED SECTIONS

- A. COORDINATION OF TESTING AND BALANCING

1.3 PAYMENT PROCEDURES

- A. The work of this Section of the Specifications shall be paid directly by the Owner.

1.4 SUBMITTALS

- A. History of the TAB organization.
- B. Agency certification.
- C. Personnel qualifications.
- D. TAB data forms.
- E. Instrumentation list.
- F. Name of the project supervising engineer.
- G. Name and address and contact person of five successfully completed projects of similar size and scope.
- H. To perform required professional services, the balancing agency shall have a minimum of one test and balance engineer certified by the Associated Air Balance Council.

1.5 TAB FIRM QUALIFICATIONS

- A. The organization performing the work shall be a Certified member in good standing of the (AABC) Associated Air Balance Council.
- B. Able to furnish evidence of having contracted for and completed not less than five systems of comparable size and type that have served their Owners satisfactorily for not less than five years.
- C. A specialist in this field and have the personnel, experience, training, skill, and the organization to perform the work.
- D. The balancing agency shall furnish all necessary calibrated instrumentation to adequately perform the specified services. An inventory of all instruments and devices in possession of the balancing agency may be required by the engineer to determine the balancing agency's performance capability.
- E. The balancing agency shall have operated for a minimum of five years under its current name.
- F. Personnel:
 - 1. The project supervisor shall be a Professional Engineer registered in Texas.
 - a. Extensive knowledge of the work involved.
 - b. At least five years experience conducting tests of the type specified.
 - c. This test and balance engineer shall be responsible for the supervision and certification of the total work herein specified.
 - 2. All work shall be conducted under the direct supervision of the supervising engineer.
 - 3. Technicians shall be trained and experienced in the work they conduct.

1.6 WARRANTY

- A. Provide (AABC) guarantee in writing.
- B. Extended warranty.
 - 1. Include an extended warranty of 2 years after completion of test and balance work, during which time the Architect/Engineer may request a retest or resetting of any outlet or other items as listed in the test report.
 - 2. Provide technicians and instruments to assist the Architect/Engineer in making any tests he may require during this period.
 - 3. The balancing agency shall perform an inspection of the HVAC system during the opposite season from that which the initial adjustments were made. The balancing agency shall make any necessary modifications to the initial adjustments to produce optimum system operation.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 TAB TOLERANCES

- A. The water, outside air, supply air, return air, and exhaust air for each system shall be adjusted to within +/- 5% of the value scheduled on the drawings.

3.2 SITE VISITS

- A. During construction, the balancing agency shall inspect the installation of the piping systems, sheetmetal work, temperature controls, energy management system, and other component parts of the heating, ventilating, and air conditioning systems. One inspection shall take place when 60% of the ductwork is installed and another inspection shall take place when 90% of the equipment is installed. The balancing agency shall submit a brief written report of each inspection to the architect and engineer.
- B. Upon completion of the installation and start-up of the mechanical equipment by the mechanical contractor, the balancing agency shall test and balance the system components to obtain optimum conditions in each conditioned space of the building. If construction deficiencies are encountered that preclude obtaining optimum conditions, and the deficiencies cannot be corrected by the mechanical contractor within a reasonable period of time, the balancing agency shall cease testing and balancing services and advise the architect, engineer, general contractor and owner, in writing, of the deficiencies.
- C. Note proper piping installation, location of valves, and flow measuring instruments.
- D. Make one series of visits, phased as required by construction progress, prior to installation of the ceiling. Note proper installation of balancing dampers.
- E. Continue the site visits up to completion of project. In each succeeding report, list corrections made from previous reports.

3.3 TESTING INSTRUMENTS

- A. Submit a list of all instruments to be used for the test and balance procedures.
 - 1. Catalog sheets
 - 2. Certificate of last calibration
 - 3. Calibration within a period of six months prior to balancing
- B. Testing equipment shall be in good working order and tested for accuracy prior to start of work.

3.4 COORDINATION WITH OTHER SPECIFICATION SECTIONS

- A. Review the related ductwork shop drawings and piping shop drawings. Make recommendations concerning suitability with respect to the testing, balancing and adjusting work.

- B. Make tests to verify proper placement of the static pressure sensors for the variable air volume fan system control.
- C. In cooperation with the work specified in Building Management and Control System section, a systematic listing of the testing and verification shall be included in the final TAB report. The TAB firm shall provide a laptop computer to operate with the Building Management and Control System. Building Management and Control System shall provide all necessary software and special interface cables, as required, to communicate with the DDC system:
 - 1. Work with the temperature control contractor to ensure the most effective total system operation within the design limitations, and to obtain mutual understanding of the intended control performance.
 - 2. Verify that all control devices are properly connected.
 - 3. Verify that all dampers, valves, and other controlled devices, are operated by the intended controller.
 - 4. Verify that all dampers and valves are in the position indicated by the controller (open, closed or modulating).
 - 5. Verify the integrity of valves and dampers in terms of tightness of close-off and full open positions. This includes dampers in multizone units, terminal boxes and fire/smoke dampers.
 - 6. Observe that all valves are properly installed in piping system in relation to direction of flow and location.
 - 7. Observe the calibration of all controllers.
 - 8. Verify the proper application of all normally opened and normally closed valves.
 - 9. Observe the locations of all thermostats and humidistats for potential erratic operation from outside influences such as sunlight, drafts or cold walls.
 - 10. Observe the location of all sensors to determine whether their position will allow them to sense only the intended temperatures or pressures of the media. Control contractor will relocate as deemed necessary by the Engineer.
 - 11. Verify that the sequence of operation for any control mode is in accordance with the approved shop drawings and specifications. Verify that no simultaneous heating and cooling occurs.
 - 12. Verify the correct operation of all interlock systems and installation is per the manufacturer recommendations.
 - 13. Check all dampers for free operation.
 - 14. Verify that all controller setpoints meet the design intent.
 - 15. Perform variable volume system verification to assure the system and its components track with changes from full flow to minimum flow.
- D. Upon completion of the testing and balancing, submit three days prior notice that the systems are ready for a running test. A qualified representative of the test and balance organization shall be present, with a representative from the engineers office, to field verify TAB report readings. Specific and random selections of data recorded in the certified test and balance report will be reviewed.

3.5 INSTRUMENT TEST HOLES

- A. When it is required to make holes in the field to measure temperature, static pressure or velocity in the ducts:
 - 1. Drill holes, plug and tape external duct insulation.
 - 2. Repair damaged insulation to Engineer's approval.

3.6 TESTING THE AIR DISTRIBUTION SYSTEM

- A. The TAB agency shall verify that all ductwork, dampers, grilles, registers, and diffusers have been installed per design and set full open. The TAB agency shall perform the

following TAB procedures in accordance with the AABC National Standards and all results shall be recorded in the TAB report:

1. Supply Fans:
 - a. Fan speeds: Test and adjust fan RPM to achieve design CFM requirements.
 - b. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure fan motor is not in or above the service factor.
 - c. Pitot-Tube Traverse: Perform a Pitot-Tube traverse of the main supply and return ducts, as applicable, to obtain total CFM. If a Pitot-Tube traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet. Measurements must be recorded with an Inclined Manometer or an Inclined/Vertical Manometer.
 - d. Outside Air: Test and adjust the outside air on applicable equipment using a Pitot-Tube traverse. If a Pitot-Tube traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet. If a traverse is not practical, use the mixed air temperature method, if the inside and outside temperature difference is at least 20°F, or use the difference between Pitot-tube traverse of the supply and return ducts.
 - e. Static Pressure: Test and record system static pressure, including the static pressure profile of each supply fan.
 2. All Other Fans:
 - a. Fan speeds: Test and adjust fan RPM to achieve design CFM requirements.
 - b. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure fan motor is not in or above the service factor.
 - c. Pitot-Tube Traverse: Perform a Pitot-Tube traverse of the main return ducts, as applicable, to obtain total CFM. If a Pitot-Tube traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet. Measurements must be recorded with an Inclined Manometer or an Inclined/Vertical Manometer.
 - d. Static Pressure: Test and record system static pressure, including the static pressure profile of each return fan.
 3. VAV Terminal Units:
 - a. Set and record volume regulators on all terminal boxes to meet design maximum and minimum CFM requirements.
 - b. Identification: Identify the type, location, and size of each terminal unit. This information must be recorded on the terminal box data sheets.
 4. Diffusers, Registers and Grilles:
 - a. Tolerances: Test, adjust, and balance each diffuser, grille, and register to within 5% of design requirements. Minimize drafts. Observe throws are in direction as indicated on drawings.
 5. Coils (including electric coils):
 - a. Air Temperature: Once air flows are set to acceptable limits, take wet bulb (cooling coil only) and dry bulb air temperatures on the entering and leaving side of each coil. Calculate the sensible and latent (cooling coil only) capacity of the coil. Provide information in TAB report.
- B. Record preliminary air handler data, including fan RPM and static pressures across filter, fans and coils.
- C. Perform a velocity traverse of the main supply ducts using a pitot-tube and inclined

manometer to establish initial air delivery. Perform a Pitot-tube traverse of main supply and return ducts, as applicable, to obtain total CFM. If a pitot-tube traverse is not practical, a detailed explanation of why a traverse was not made must appear on the appropriate data sheet.

- D. Where air measuring stations are installed, use pitot tube traverse readings to verify and record the correct calibration of the stations output.
- E. Make adjustments in fan RPM and damper settings, as required, to obtain design supply air, return air, and outside air.
- F. Measure and adjust all supply and return branches to design air delivery.
- G. Measure and adjust all diffusers to design air delivery to +/- 5% of design requirements.
- H. Make a set of recordings showing final system conditions.

3.7 TESTING THE HYDRONIC SYSTEMS

- A. The TAB agency shall, as applicable, verify that all hydronic equipment, piping, and coils have been filled and purged; that strainers have been cleaned; that water has been flushed and is in a clean condition, and that all balancing valves (except bypass valves) are set full open. As applicable, check air vents and expansion or compression tank for proper operation. The TAB agency shall perform the following testing and balancing functions in accordance with the AABC National Standards and all results shall be recorded in the TAB report:
 - 1. Record preliminary pump data.
 - a. Pump RPM.
 - b. Pump shut-off differential head.
 - c. Pump operating differential head.
 - d. Check and verify pump alignment.
 - e. Verify impeller diameter.
- B. Adjust balancing valves in the pump discharge lines to obtain design water quantity as read from the manufacturer's pump curve and from a flow meter.
- C. In variable flow systems, the water flow of the pump shall be set at the scheduled gpm, not the total of all the valves. Determine the diversity of the system and balance the individual coils with the maximum pump water quantity flowing in the system.
- D. Balance flow through:
 - 1. Chillers.
 - 2. Coils.
 - 3. Boiler.
 - 4. Pumps
 - 5. Condensers.
 - 6. Cooling tower.
 - 7. Heat Exchanger.
- E. Use flow meters, differential pressures and temperature relationships as required.
- F. Balance by-pass lines to obtain the same pressure drop with systems on by-pass as full flow through the coil including the valve.
- G. Repeat steps, as required, to obtain a final systems balance and make a set of recordings showing final systems conditions.
- H. Pumps:
 - 1. Test and adjust pumps to meet design water flow requirements. Check pumps for proper operation. Pumps shall be free of vibration and cavitation Record appropriate gauge readings for final TDH and Block-Off\Dead head calculations. Check and verify pump alignment.
 - 2. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure pump motor is not in or above the service factor.

- I. Coils:
 - 1. Tolerances: Test, adjust, and balance all chilled water and hot water coils within 5% of design flow requirements.
 - 2. Verification: Verify the type, location, final pressure drop and water quantity (GPM) of each coil. Calculate the actual capacity of all coils. This information shall be recorded on coil data sheets.
- J. Boilers:
 - 1. Verify that boilers have been filled and started by others, and are in operation.
 - 2. Current and Voltage: As applicable, test and record motor voltage and amperage, and compare data with the nameplate limits to ensure motor is not in or above the service factor.
 - 3. Test, adjust and record water flows through water boilers.
 - 4. Test and record water temperature profiles of each boiler.
- K. Chillers:
 - 1. Verify that chillers have been started by the manufacture and are in operation. Test and adjust chiller water flows to within 5% of the design requirements by using a U-TUBE manometer and setting balancing valves.
 - 2. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure compressor motor is not in or above the service factor.
 - 3. Test and record temperature profiles of each chiller at design water flow.
- L. Cooling towers:
 - 1. Verify that cooling towers have been filled and started by others and are in operation.
 - 2. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure cooling tower fan motor is not in or above the service factor.
 - 3. Test and adjust water flows to balance tower cells and flows between towers.
 - 4. Test and record water temperature profiles of each condenser at design water flow for water and air side operation.
- M. Heat exchangers:
 - 1. Verify that heat exchangers have been filled and started by others, and are in operation.
 - 2. Test and record temperature and pressure profiles of water and steam heat exchangers.

3.8 EQUIPMENT POWER READINGS

- A. Record the following information for each motor:
 - 1. Equipment designation.
 - 2. Manufacturer.
 - 3. Unit model number and serial number and frame.
 - 4. Motor nameplate horsepower; nameplate voltage; phase and full load amperes.
 - 5. Heater coil in starter.
 - a. Rating in amperes.
 - b. Manufacturer's recommendation.
 - 6. Motor RPM/driven equipment RPM.
 - 7. Power reading (voltage, amperes of all legs at motor terminals).

3.9 BOILERS

- A. Check for proper operation and with operation at near design conditions, record the following:
 - 1. Manufacturer, model number, serial number and nameplate.

2. If water type, water flow in GPM, entering and leaving water temperature and water pressure drop in feet.
 3. Type of fuel and heating value.
 4. Rate of fuel consumption.
 5. Capacity in MBH.
 6. Efficiency.
 7. Flue gas analysis.
 8. Motor data.
- B. Observe demonstration that all controls and safety devices are functioning properly. Record observations.

3.10 CHILLERS (Water Cooled)

- A. Balance flow of water thru each evaporator and condenser to be within a range of 100% to 110% of design flow with all pumps operating. With only one pump operating, the maximum flow shall not exceed the maximum tube velocity recommended by the manufacturer.
- B. Verification of safety interlocks and controls are the responsibility of the manufacturer.
- C. With each chiller operating at near design temperature and water flow conditions, measure and record the following:
1. Manufacturer, model number, serial number and all nameplate data.
 2. Evaporator water entering temperature, leaving temperature, pressure drop (ft.) and water quantity (GPM).
 3. Condenser water entering temperature, leaving temperature, pressure drop (ft.) and water quantity (GPM).
 4. Evaporator and condenser refrigerant temperatures and pressures (using instruments furnished with the machine by the manufacturer).
 5. Volts and amps for each phase.
 6. Power factor.
 7. KW input.
 8. Tons of cooling.
 9. KW per ton of cooling.
- D. Reference chiller specification for additional requirements.

3.10 CHILLERS (Air Cooled)

- A. Balance flow of water through each evaporator to be within a range of 100% to 110% of design flow with all pumps operating. With only one pump operating, the maximum flow shall not exceed the maximum tube velocity recommended by the manufacturer.
- B. Verification of safety interlocks and controls are the responsibility of the manufacturer.
- C. With each chiller operating at near design temperature conditions, measure and record the following:
1. Manufacturer, model number, serial number and all nameplate data.
 2. Evaporator water entering temperature, leaving temperature, pressure drop (ft.) and water quantity (GPM).
 3. Condenser air entering temperature, leaving temperature.
 4. Evaporator and condenser refrigerant temperatures and pressures (using instruments furnished with the machine by the manufacturer).
 5. Volts and amps for each phase.
 6. Power factor.
 7. KW input.
 8. Tons of cooling.
 9. KW per ton of cooling.
- D. Reference chiller specification for additional requirements.

3.11 TESTING THE VARIABLE AIR VOLUME SYSTEM

- A. All VAV boxes used are to be calibrated to produce the rated air quantity.
- B. Set and record the supply air static pressure controller to provide actual design air flow at the most resistive terminal.
- C. Measure and adjust the design air delivery at the inlet of each VAV box.
- D. Measure and record the air quantity from each VAV box at its maximum flow. Manipulate the controller to achieve maximum flow.
- E. Reset each box to yield and record minimum primary air flow.
 - 1. DDC controllers record the correction factor required to establish actual desired air quantity as designed.
 - 2. Pneumatic controllers adjust velocity controller as required to establish actual desired air quantity as designed.
- F. If the box is operating with inlet static pressure in excess of the minimum cataloged pressure specified by the manufacturer and is not producing rated air quantity, field adjust the box to produce rated air quantity. Retest until approved results are obtained.
- G. Position the VAV boxes to the proportion of maximum fan air volume to total installed box maximum volume.
- H. Set the fan to deliver the AHUs scheduled design airflow.
- I. Perform and record a total air traverse.
- J. With the system terminal boxes set for full flow or diversity, the system will be delivering the scheduled design CFM with the most restrictive box in control. Make a speed increase if either or both static and volume are low.
- K. Set the boxes to minimum and adjust the inlet vanes and or speed controllers to prevent excessive static in the system.
- L. Coordinate with the work specified in Building Management and Control System on the final location of the sensors for the static pressure controller. Locate in the supply duct far enough from the fan discharge to be truly representative of the average static pressure in the system.
- M. Modulate the fan speed on the supply fan. Adjust as required to coordinate with the static pressure sensing network.
- N. Make a set of recordings showing final system conditions including system duct static pressures and control system setpoint.

3.12 DUCT TEST

- A. Test and Balancing Contractor shall verify and record the duct test results. A copy of the duct test results, as completed, shall be submitted to the engineer for review within five days. Provide a complete report of all the duct test results in the final TAB report.

3.13 DIRECT EXPANSION EQUIPMENT

- A. With each unit operating at near design conditions, measure and record the following:
 - 1. Manufacturer, model number, serial number and all nameplate data.
 - 2. Ambient temperature, condenser discharge temperature.
 - 3. Amperage and voltage for each phase.
 - 4. Leaving and entering air temperatures.
 - 5. Suction and discharge pressures and temperatures.
 - 6. Tons of cooling.
 - 7. Verification that moisture indicator shows dry refrigerant.

3.14 TAB REPORT

- A. The activities described in this specification shall be recorded in a report form; and four

individually bound copies shall be provided to the Architect and Engineer. Neatly type and arrange data. Include with the data the date tested, personnel present, weather conditions, nameplate record of the test instruments used and list all measurements taken after all corrections are made to the system. Record all failures and corrective action taken to remedy any incorrect situation. The intent of the final report is to provide a reference of actual operating conditions for the Owner's operations personnel. Provide a "Preface" which shall include a general discussion of the system and any abnormalities or problems encountered.

- B. All measurements and recorded readings (of air, water, electricity, etc.) that appear in the report must have been recorded on site by the permanently employed technicians or engineers of the TAB firm.
- C. Submit reports on forms approved by the engineer that will include the following data as a minimum:
 - 1. Title Page
 - a. Company Name
 - b. Company Address
 - c. Company telephone number
 - d. Project name
 - e. Project location
 - f. Project Manager
 - g. Project Engineer
 - h. Project Contractor
 - i. Project Identification Number
 - 2. Summary of the TAB report data
 - 3. Index
 - 4. Instrument List
 - a. Instrument
 - b. Manufacturer
 - c. Model
 - d. Serial Number
 - e. Range
 - f. Calibration Date
 - g. What test instrument is to be used for:
 - 5. Fan Data
 - a. Location
 - b. Manufacturer
 - c. Model
 - d. Air flow, specified and actual
 - e. Total static pressure (total external) specified and actual
 - f. Inlet pressure
 - g. Discharge pressure
 - h. Fan RPM
 - 6. Return Air/Outside Air Data
 - a. Identification/location
 - b. Design return air flow
 - c. Actual return air flow
 - d. Design outside air flow
 - e. Actual outside air flow
 - f. Return air temperature
 - g. Outside air temperature
 - h. Required mixed air temperature
 - i. Actual mixed air temperature

7. Electric Motors
 - a. Manufacturer
 - b. HP/BHP
 - c. Phase, voltage, amperage, nameplate, actual
 - d. PM
 - e. Service Factor
 - f. Starter size, heater elements, rating
8. V-Belt Drive
 - a. Identification/location
 - b. Required driven RPM
 - c. Drive sheave, diameter and RPM
 - d. Belt, size and quantity
 - e. Motor sheave, diameter and RPM
 - f. Center-to-center distance, maximum, minimum and actual
9. Duct Traverse
 - a. System zone/branch
 - b. Duct size
 - c. Area
 - d. Design velocity
 - e. Design air flow
 - f. Test velocity
 - g. Test air flow
 - h. Duct static pressure
 - i. Air correction factor
10. Air Monitoring Station Data
 - a. Identification/location
 - b. System
 - c. Size
 - d. Area
 - e. Design velocity
 - f. Design air flow
 - g. Test velocity
 - h. Test air flow
11. Air Distribution Test Sheet
 - a. Air terminal number
 - b. Room number/location
 - c. Terminal type
 - d. Terminal size
 - e. Correction factor
 - f. Design velocity
 - g. Design air flow
 - h. Test (final) velocity
 - i. Test (final) air flow
12. Pump Data
 - a. Identification/number
 - b. Manufacturer
 - c. Size/model
 - d. Impeller
 - e. Service
 - f. Design flow rate, pressure drop, BHP
 - g. Actual flow rate, pressure drop, BHP
 - h. Discharge pressure

- l. Suction pressure
 - j. Total operating head pressure
 - k. Shut off, discharge and suction pressures
 - l. Shut off, total head pressure
 - m. Pressure differential settings
13. Cooling Coil Data
- a. Identification/number
 - b. Location
 - c. Service
 - d. Manufacturer
 - e. Entering air DB temperature, design and actual
 - f. Entering air WB temperature, design and actual
 - g. Leaving air DB temperature, design and actual
 - h. Leaving air WB temperature, design and actual
 - i. Water pressure flow, design and actual
 - j. Water pressure drop, design and actual
 - k. Entering water temperature, design and actual
 - l. Leaving water temperature, design and actual
 - m. Air pressure drop, design and actual
 - n. Capacity - sensible and latent
14. Heating Coil Data
- a. Identification/number
 - b. Location
 - c. Service
 - d. Manufacturer
 - e. Entering air DB temperature, design and actual
 - f. Leaving air DB temperature, design and actual
 - g. Water pressure flow, design and actual
 - h. Water pressure drop, design and actual
 - i. Entering water temperature, design and actual
 - j. Leaving water temperature, design and actual
 - k. Air pressure drop, design and actual
 - l. Capacity
15. Electric Coil Data
- a. Identification/number
 - b. Location
 - c. Service
 - d. Manufacturer
 - e. Entering air DB temperature, design and actual
 - f. Leaving air DB temperature, design and actual
 - g. Electrical Characteristics
 - h. Capacity
16. Sound Level Report
- a. Location (Location established by the design engineer)
 - b. N C curve for eight (8) bands-equipment off
 - c. N C curve for eight (8) bands-equipment on
17. Vibration Test on equipment having 10 HP motors or greater in size.
- a. Location of points:
 - 1) Fan bearing, drive end
 - 2) Fan bearing, opposite end
 - 3) Motor bearing, center (if applicable)
 - 4) Motor bearing, drive end

- 5) Motor bearing, opposite end
- 6) Casing (bottom or top)
- 7) Casing (side)
- 8) Duct after flexible connection (discharge)
- 9) Duct after flexible connection (suction)
- b. Test readings:
 - 1) Horizontal, velocity and displacement
 - 2) Vertical, velocity and displacement
 - 3) Axial, velocity and displacement
- c. Normally acceptable readings, velocity and acceleration
- d. Unusual conditions at time of test
- e. Vibration source (if non-complying)
- 18. Control verification indicating date performed and any abnormalities identified.
 - a. Point Location/Description
 - b. EMS Readout (Setpoint and Actual)
 - c. Actual Readout of all points
 - d. Interlocks
 - e. Safeties
 - f. Variable speed drive tracking with EMS input
 - g. Variable speed drive Bypass operation
 - h. Sequence of operation

END OF SECTION

**SECTION 23 0594
COORDINATION OF TESTING AND BALANCING**

PART 1 - TESTING, BALANCING AND ADJUSTING

1.1 WORK INCLUDED

- A. Balancing and adjusting of the environmental systems is specified in Section 23 05 93.
- B. Coordination of the work is specified in this Section.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 COORDINATION

- A. Bring the work to a state of readiness for testing, balancing, and adjusting.
 - 1. Install air terminal devices.
 - 2. Provide specified filters in air handling equipment. Install clean filters just prior to the start of the test and balance work.
 - 3. Verify lubrication of equipment.
 - 4. Install permanent instrumentation.
 - 5. Clean piping systems and fill with clean water.
 - 6. Complete "Start-up" of equipment.
 - 7. Check rotation and alignment of rotating equipment and tension of belted drives.
 - 8. Verify ratings of overload heaters in motor starters.
 - 9. Verify that safety and operating control set points are as designed and automatic control sequences have been checked.
 - 10. Provide control diagrams and sequence of operation.
 - 11. Collect material for maintenance manuals and prepare one manual especially for use in testing and balancing.
 - 12. Verify that graphic operational data such as start/stop instructions, valve tag schedules, and piping identification schedules have been provided where needed.
 - 13. Verify that equipment and piping identification work has been completed with valve tags, schedules, and piping identification system.
 - 14. Comb out fins on extended-surface heat transfer coils where damaged.
 - 15. Clean all strainers as required.
 - 16. Remove construction strainers after water is cleaned and treated.
 - 17. Remove all temporary filters from HVAC equipment.
 - 18. Provide start-up reports listing all start-up information and manufacturer's information attached.
- B. Provide and install new pulleys and belts as required to effect the correct speed ratio. Adjustments where no belt or pulley change is required, is specified in Section 23 05 93.
- C. Verify that the systems are ready for balancing and adjusting.
- D. Submit a letter stating:
 - 1. The specified pieces of equipment have been checked, started, and adjusted by the manufacturer.
 - 2. Other equipment has been checked and started.
 - 3. The systems have been operated for the specified period of time.
 - 4. The automatic controls system has been adjusted, calibrated, and checked, and is operating as specified.
- E. Provide the services of a technician full time at all times at the project when testing, balancing and adjusting work is being conducted.
- F. Provide instrumentation and services to take readings of the required data for the refrigerant circuits.
- G. Provide and install volume dampers required for balancing by the TAB Contractor.

3.2 START-UP OF EQUIPMENT

- A. Pre-start & Start-up equipment using the procedures as recommended by the manufacturers.
- B. Complete start-up of equipment prior to start of testing & balancing.
- C. Submit start-up procedures as outlined by the manufacturers and complete the "HVAC FAN / AIR HANDLING / START-UP REPORT FORM" to Engineer.

HVAC FAN / AIR HANDLING UNIT / START-UP REPORT FORM														
Equipment Description	Actual			Disc. Switch Wired	Rotatio n Correct	Belt		RPM Correct Submitt al	Vibratio n Isolation Correct	Attachme nt To Roof Curb	List Of Damage Parts	Bearings Lubricat ed	Filter Installed	Interlocks & Dampers Operational
	Voltag e	Amps	HP			Condition & Part #	Tension Correct							

END OF SECTION

SECTION 23 0713
EXTERNAL DUCT INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install external insulation on supply, return and outside air ductwork.
- B. External insulation of concealed and exposed ducts is included in this Section. Internal acoustic duct lining is specified under ductwork and not included in this Section.

1.2 RELATED WORK

- A. Division 9 - FINISHES. Painting and Color Coding.
- B. Division 23 - MECHANICAL.
 - 1. Air Handling Units. Internal insulation for air units is specified in the sections on air handling units. The units do not require external insulation.
 - 2. Internal Duct Liner. Internal duct liner is specified in the section on ductwork.
 - 3. Insulation. Refer to specific sections on individual insulation types.
 - 4. Refer to insulation and liner plan detail.

1.3 QUALITY ASSURANCE

- A. The intent of insulation specifications is to obtain superior quality workmanship, resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.
- B. An approved contractor for this work under this Division shall be:
 - 1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
 - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their Owners satisfactorily for not less than 3 years.
- C. All duct insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50 as determined by test procedures ASTM E84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.
- D. Condensation on any insulated system is not approved.
- E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also repair any damage caused by the condensation.
- F. Where existing insulated ductwork or other services are tapped, remove existing insulation back to undamaged sections and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.4 APPROVALS

- A. Submittals. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in Division 1 General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location, and the manufacturer's installation instructions for each product.
- B. Sample Application. Make an application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

PART 2 - PRODUCTS

2.1 INSULATION

- A. Glass fiber rigid duct insulation.
 - 1. Minimum density of 3 pcf, installed R value to be 6.0 (when located in a conditioned plenum) and 8.0 (when located in an unconditioned plenum) at 75°F mean, facing of 0.7 mil aluminum foil reinforced with glass yarn mesh and laminated to 40 lbs. fire-resistant Kraft. R-value to be indicated on exterior side of insulation to be verified by City inspector.
 - 2. Acceptable Manufacturers
 - a. Schuller 814 spin-glas FSK.
 - b. Owens-Corning Type 703 board RKF.
 - c. Knauf 3 PCF FSK.
- B. Glass fiber blanket duct insulation.
 - 1. Minimum density of 1.0 pcf, installed R value to be 6.0 (when located in a conditioned plenum) and 8.0 (when located in an unconditioned plenum) at 75°F mean, facing of 0.35 mil foil reinforced with glass yarn mesh and laminated to 40 lbs. fire resistant Kraft. R-value to be indicated on exterior side of insulation to be verified by City inspector.
 - 2. Acceptable Manufacturers
 - a. Manville R-series Microlite FSKL.
 - b. Owens-Corning ED100 RKF.
 - c. Knauf 1.0 PCF FSK.
- C. Fiberglass reinforcing cloth mesh.
 - 1. Acceptable Manufacturers
 - a. Perma Glass Mesh.
 - b. Alpha Glass Mesh.
 - c. Childers Chil-Glas #10
 - d. Foster Mast a Fab
 - e. Vimasco.
- D. Mastics, sealants, coatings and adhesives.
 - 1. Acceptable Manufacturers
 - a. Childers.
 - B. Foster.
 - c. Vimasco.
- E. Fireboard Insulation
 - 1. Totally encapsulated with foil facing.
 - 2. Two hour rated fire protection.
 - 3. Zero clearance to combustible protection.
 - 4. System shall be listed and labeled by an NRTL.
 - 5. Tested per ISO 6944, Type A Duct and achieve a 2 hour rating for stability, integrity and insulation.
 - 6. Provided system is subject to the approval of the Local Authority Having Jurisdiction.
 - 7. Acceptable Manufacturers
 - a. Unifrax ON Fyrewrap Elite 1.5
 - b. Partak Insulation, Inc. Paroc Fireboard
 - c. Thermal Ceramics FireMaster 3M
 - d. Premier Refractories International, Pyroscat.
- F. Rigid Closed Cell Insulation
 - 1. Acceptable Manufacturers
 - a. Dow Trymer.
 - b. Phenolic Foam.

- G. Reinforced Foil Tape
 - 1. Acceptable Manufacturers
 - a. Venture 1525CW
 - b. 3" FSK
 - 2. Thickness 6.5 mils
 - 3. Color: silver

2.2 COATING AND ADHESIVE

- A. Coating. Provide Childers CP-38 or Foster 30-80 vapor barrier coating. Coating must meet MIL Spec C-19565C, Type II and be QPL Listed. Permeance shall be 0.013 perms or less at 43 mils dry. Tested at 100°F and 90% RH per ASTM E96.
- B. Outdoors: Provide as insulation coating Childers Encacel X or Foster Monolar 60-90. Permeance shall be 0.03 perms or less at 30 mils dry. Tested at 100°F and 90% RH per ASTM F 1249.
- C. Adhesive. Provide Childers CP-82 or Foster 85-20 vapor barrier adhesive.
- D. Reinforcing Mesh. Provide 10 x 10 white glass or polyester reinforcing mesh.

2.3 OUTDOOR DUCT LAMINATED JACKETING

- A. Rubberized bitumen compound material:
 - 1. Ultraviolet resistant
 - 2. Weatherproof
 - 3. Vapor retarding jacketing
 - 4. Laminated jacketing
 - 5. Cross-laminated high strength polyethylene film
 - 6. Laminated to aluminum foil
 - 7. Minimum 60-mil thickness
- B. Acceptable Manufacturers:
 - 1. Alumaguard 60
 - 2. Flex Clad 400
 - 3. Venture Clad 1577CW

PART 3 - EXECUTION

3.1 FIRE SAFETY REQUIREMENTS

- A. Do not extend duct coverings through walls or floors required to be fire-stopped or required to have a fire resistance rating. Interrupt duct coverings in the immediate vicinity of heat sources such as electric resistance or fuel-burning heater.

3.2 CONCEALED DUCT

- A. Provide flexible glass fiber insulation with factory-applied, reinforced UL labeled Foil-Skrim-Kraft (FSK) facing.
- B. Standing Seams. Insulate standing seams and stiffeners, which protrude through the insulation with 0.6 lb. per cubic foot density, 1-1/2" thick, faced, flexible blanket insulation. Insulation shall not prevent adjustment of damper operators.
- C. Insulation shall be wrapped tightly on the ductwork with all circumferential joints butted and longitudinal joints overlapped a minimum of 2". In addition, secure insulation to the bottom of rectangular ductwork by the use of either weld pins with washers or cup-head pins welded to the ductwork or perforated based insulation hangers glued to the duct on twelve inch centers to prevent sagging of insulation.
- D. On circumferential joint, the 2" flange on the facing shall be stapled with 9/16" outward clinch steel staples on 2" centers and taped using 3" wide foil tape applied with additional adhesive of Foster 85-75. Cover all seams, joints, pin penetrations and other breaks with foil tape and glue.
- E. Ductwork in mechanical rooms is considered concealed spaces.

3.3 EXPOSED DUCT INSULATION

- A. Ductwork in exposed locations is to be insulated with fiberglass rigid / semi-rigid board insulation.
 - 1. Apply fabric and mastic to provide a smooth surface for painting.
- B. Standing Seams: Insulate standing seams and stiffeners which protrude through the insulation with 0.6 lb per cubic foot density, 1-1/2 inch thick, faced insulation. As a vapor seal, use reinforcing mesh with vapor barrier coating. Insulation shall not prevent adjustment of damper operators.
- C. Insulation shall be wrapped tightly on the ductwork. Adhere insulation to ductwork with adhesive. In addition, secure insulation to the bottom of rectangular ductwork by the use of either weld pins with washers or cup-head pins welded to the ductwork or perforated based insulation hangers glued to the duct on 12 inch centers to prevent sagging of insulation.
- D. Cover all seams, joints, pin penetrations and other breaks with coating reinforced with reinforcing mesh. Fabric shall not be visible after coating.

3.4 OUTDOOR DUCTWORK COVERING

- A. Cover all supply and return ductwork outdoors:
 - 1. 1-1/2" thick, rigid closed cell insulation with reinforced foil facing.
- B. Install a high point in center and slope in both directions so water will not stand on horizontal surfaces.
- C. Impale the insulation over mechanical fasteners and washers.
 - 1. A minimum of 2 rows of fasteners per side on 12-inch centers.
 - 2. Seal all breaks, joints and punctures by applying a 1/8" thick vapor barrier mastic coating, embedded in open mesh reinforcing mesh.
- D. Standing S, or flanged connections shall be covered with the same thickness of insulation overlapped a minimum of 4".
- E. Apply a tack coat of Childers CP-10/11 or Foster 46-50 weather barrier mastic over the entire surface.
 - 1. While this coat is still tacky, Childers #5 glass fiber reinforcing mesh shall be smoothly applied and pressed into the mastic. The cloth shall be taut with adjacent edges overlapped a minimum of 4".
 - 2. After the first coat of mastic has taken its set, the second coat shall be applied over the cloth by palm, trowel, or spray to sufficient thickness that, when dried, the combined thickness of mastic and cloth is not less than 1/8".
 - 3. Upon completion, the openings in the cloth shall be completely sealed and the yarn shall not be visible. The completed work shall be completely smooth and present a plane surface.
 - 4. Aluminum gray or white finish as approved by the Architect.
- F. Standing water on horizontal surfaces is not approved.
- G. Apply outdoor duct laminated jacketing protection over entire insulation surface. Apply rubberized bitumen compound, applied to a cross-laminated high strength polyethylene film, laminated to aluminum foil.

3.5 KITCHEN GREASE EXHAUST DUCTWORK / KILN DUCTWORK / FUME HOOD DUCT

- A. Secure fireboard insulation to duct with impaling pins and 3" square speed clips. In addition, provide a wire mesh support system and additional sealing or support as required by the code enforcing authority. The insulation support system shall include framed access to allow the insulation to be removed and replaced without damage at the access doors in the duct system for inspection and cleaning. Coordinate location of access openings to correspond accurately. Provide stainless steel banding on 12" centers.

3.6 GENERAL INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Apply insulation on clean, dry surfaces only.
- C. Continue insulation with vapor barrier through penetrations.
- D. Neatly finish insulation at supports, protrusions and interruptions.
- E. Install insulation on clean, dry surfaces, and only after building is weatherproofed sufficiently to preclude any rainwater on insulation.
- F. Apply mastic over the fiberglass reinforcing mesh to a thickness where fabric is not visible after completion.
- G. Install fiberglass blanket duct insulation on top of supply air grilles not fire rated.

END OF SECTION

**SECTION 23 0719
HVAC PIPING INSULATION**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install piping insulation, jackets, accessories and covering of specified materials. The insulation shall be used for high and low temperature piping applications including chilled water, hot water, and condensate piping.

1.2 QUALITY ASSURANCE

- A. The intent of insulation specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.
- B. An approved contractor for this work under this Division shall be:
 - 1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
 - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their owners satisfactorily for not less than 3 years.
- C. All piping insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50, as determined by test procedures ASTM E 84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.
- D. Condensation on any insulated piping system is not acceptable.
- E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also repair any damage caused by the condensation.
- F. Where existing insulated piping, or other surfaces are tapped, remove existing insulation back to undamaged sections for hot surfaces or to nearest insulation stop for cold surfaces, and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.3 SUBMITTALS

- A. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location and the manufacturer's installation instructions for each product.
- B. Make a field application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

1.4 RELATED WORK

- A. Finishes. Painting and color-coding
- B. Pipe Heat Tracing

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Glass fiber pipe insulation:
 - 1. Johns-Manville Micro-Lok AP-T
 - 2. Owens-Corning ASJ/SSL

- 3. Knauf ASJ/SSL
- B. Cellular Glass Insulation (Foamglass):
 - 1. Pittsburg Corning
 - 2. Cell-U-Foam
- C. Rigid Foam Insulation:
 - 1. Koolphen - Phenolic Foam
 - 2. Dow Trymer
 - 3. Tarec Ecophen – Phenolic Foam
- D. Aluminum Jacketing:
 - 1. ITW Lock-on (Childers)
 - 2. ITW Z-lock (Pabco)
- E. Fiberglass reinforcing cloth mesh:
 - 1. Perma Glass Mesh
 - 2. Alpha Glass Mesh
 - 3. Childers Chil-Glas
 - 4. Foster Mast a Fab
 - 5. Vimasco
- F. Mastics, Sealants, Coatings and Adhesives
 - 1. Childers
 - 2. Foster
 - 3. Vimasco
 - 4. Armstrong 520 Adhesive
- G. Elastomeric Insulation
 - 1. Armacell
- H. Weather Resistant Coating
 - 1. WB Armaflex Finish
 - 2. Foster 30-64
- I. Glass fiber blanket insulation
 - 1. Manville R-series Microlite FSKL
 - 2. Owens-Corning eD75 or ED100 RKF
 - 3. Knauf 0.75 PCF FSK

2.2 RIGID FOAM PIPE INSULATION

- A. Polyisocyanurate pipe insulation or phenolic foam pipe insulation, with all service reinforced vapor barrier jacket having integral laminated vapor barrier.
 - 1. Polyisocyanurate: Thermal conductivity 0.14 @ 75°F mean (ASTM C518).
 - 2. Phenolic Foam: Thermal conductivity 0.13 @ 75°F mean (ASTM C 518); minimum 2.5# density.
 - 3. Polyisocyanurate is not to be used inside of buildings without 25/50 rating.

2.3 FIBERGLASS PIPE INSULATION

- A. Heavy density, dual temperature fiberglass insulation with factory applied, all service, reinforced vapor barrier jacket having integral laminated vapor barrier. Provide with a factory applied pressure sensitive tape closure system and matching butt strips. Supply in thickness as shown.
 - 1. Thermal conductivity 0.23 @ 75°F mean (ASTM 335).

2.4 ELASTOMERIC INSULATION

- A. Insulation material shall be flexible, closed-cell elastomeric insulation in tubular or sheet form. Material shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84, latest revision. Sheet material with a thickness greater than ¾" shall have a flame spread rating of 25 or less and a smoke developed rating of 100 or less when tested in accordance with ASTM E84, latest revision. In addition, the product, when tested, shall not melt or drip flaming

particles, and the flame shall not be progressive. In addition, all materials shall pass simulated end-use fire test.

1. Thermal conductivity 0.27 at 75°F mean (ASTM C177 or C518)

2.5 CELLULAR GLASS INSULATION

- A. ASTM C552:
 1. "k" value of 0.35 @ 75°F ("ksi" value of 0.047 @ 24°C);
 2. 8.0 lb/cu.ft. (128 kg/cu.m.) density

2.6 INSULATION/SHIELD AT HANGERS

- A. Field fabricated: Use 360° sections of rigid foamglass insulation that will support the bearing area at hangers and supports. Further support insulation at hangers and supports with a shield of galvanized metal covering at least half of the pipe circumference, and conforming to the schedule. Insulation shall extend at least 1" beyond metal shield on each end. When pipe is guided at top and bottom, metal shields shall cover the whole pipe circumference. Adhere metal shield to insulation so that metal will not slide with respect to insulation with ½" aluminum bands (2) per shield.
 1. Sections of foam glass insulation may be used of the same outside diameter of the adjoining pipe insulation.
 2. Minimum thickness of foam glass insulation shall not be less than 1" thick.
- B. Pipe saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter or more than 22". Provide 18 gauge through 4" pipe and 16-gauge 5" pipe and above.

2.7 SEALANT, ADHESIVE AND FINISH

- A. Lap Adhesive. Provide Childers CP-82 or Foster 85-20 adhesive.
- B. Vapor Barrier Finish:
 1. Indoors: Provide as insulation coating Childers CP-38 or Foster 30-80, white. Coating must meet MIL Spec C-19565C, Type II and be QPL Listed. Permeance shall be 0.013 perms or less at 43 mils dry. Tested at 100°F and 90% RH per ASTM E96.
 2. Outdoors: Provide as insulation coating Childers Encacel X or Foster 60-90. Permeance shall be 0.03 perms or less at 30 mils dry. Tested at 100°F and 90% RH per ASTM F 1249 and must be Hypalon rubber based.
 3. Underground: Provide Childers CP-22/24 or Foster 60-25/26 for fittings and areas. Pittwrap cannot be used.
- C. Insulation Joint Sealant. Provide Childers CP-76 or Foster 95-50 vapor barrier sealant.
- D. Metal Jacketing Sealant. Provide Childers CP-76 or Foster 95-44 metal jacketing sealant for all outdoor metal jacketing laps.
- E. Lagging Adhesive. Provide Childers CP-50AMV1 or Foster 30-36.
- F. Other products of equal quality will be acceptable only upon approval.

2.8 ALUMINUM JACKETING

- A. Finish insulated piping outdoors with a smooth prefabricated Z-lock aluminum jacket 0.016" thick with factory applied 1 mil polyethylene/40 lb and Fab strap. Kraft moisture barrier.
- B. Valves, Fittings and Flanges. For finishing valves, fittings, flanges and similar installations, provide formed aluminum covers, 0.024" thick.
- C. Straps and Seals. Provide ½" x 0.020 stainless steel strapping and seals for jackets and covers according to manufacturer's recommendations.

2.9 GLASS FIBER BLANKET INSULATION

- A. Minimum density of 1.0 PCF, 2" thick, installed R value to be 6.0 or better at 75°F mean,

facing of 0.35 mil foil reinforced with glass yarn mesh and laminated to 40 lbs fire resistant kraft.

PART 3 - EXECUTION

3.1 INTERIOR PIPING

- A. Cover all hot water piping with glass fiber, heavy density, dual temperature pipe insulation with a vapor barrier jacket. Apply insulation to clean, dry pipes. Longitudinal seams shall be joined firmly together and sealed with self-sealing lap joints. Butt insulation joints firmly together and seal with a 3" wide ASJ butt strip seal. Longitudinal seams and butt strip laps shall be coated and sealed with CP-35 vapor barrier coating for chilled water piping applications.
- B. Cover all chilled water piping with rigid foam insulation.
 - 1. Adhere the vapor barrier jacket longitudinal seam with vapor barrier adhesive.
 - 2. Cover all valves, fittings and flanges with factory made molded or field fabricated segments of pipe insulation of a thickness and material equal to the adjoining insulation. Adhere segments together with no voids, using CP-82 adhesive. Secure fitting insulation covers and segments in place with ½" wide glass filament tape.
 - 3. Apply a tack coat of fitting mastic over the insulation and tape.
 - 4. Neatly embed with 10 x 10 fiberglass cloth into the tack coat.
 - 5. Apply mastic over the fiberglass cloth to a thickness where the fabric is not visible after completion.
 - 6. Seal ends of pipe insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the foam, down onto the pipe, making a complete seal.
- C. Install hanger with protective shield, on the outside of all insulation.
- D. Pipe Saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter. Provide 18-gauge through 4" pipe and 16-gauge for 5" pipe and above.
- E. Seal ends of pipe for chilled water insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the glass, down onto the pipe making a complete seal.
- F. Apply a smooth flood coat of white lagging Foster 8142W over all exposed insulation.
- G. Piping to be insulated as specified above:
 - 1. Chilled water and heating water
 - 2. Make-up water

3.2 REFRIGERANT AND CONDENSATE PIPING

- A. Cover all pipe with elastomeric insulation by slitting tubular sections or sliding unslit sections over the open ends of piping or tubing. Seams and butt joints shall be adhered and sealed using Foster 85-75, Childers CP-82 or Armstrong 520 Adhesive.
- B. All fittings shall be insulated with the same insulation thickness as the adjacent piping. All seams and mitered joints shall be adhered with Foster 85-75, Childers CP-82 or 520 Adhesive.
- C. Pipe Saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter.
- D. Outdoor exposed piping shall be painted with two coats of either WB or SB Armaflex finish or Foster 30-64 elastomer foam coating. All seams shall be located on the lower half of the pipe.

3.3 PIPING OUTDOORS ABOVE GRADE

- A. Insulate all chilled and hot water piping exterior of building above grade with rigid foam

- insulation and aluminum jacketing.
- B. Adhere the vapor barrier jacket longitudinal seam with vapor barrier adhesive.
- C. Cover all valves, fittings and flanges with factory made molded or field fabricated segments of pipe insulation of a thickness and material equal to the adjoining insulation. Adhere segments together with no voids, using Childers CP-82 or Foster 85-20 adhesive. Secure fitting insulation covers and segments in place with ½” wide glass filament tape.
- D. Apply a tack coat of fitting vapor barrier coating over the insulation and tape.
- E. Neatly embed with 10 x 10 fiberglass or polyester reinforcing mesh into the tack coat.
- F. Apply coating over the fiberglass cloth to a thickness where the mesh is not visible after completion.
- G. Seal ends of pipe insulation with vapor barrier coating at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the foam, down onto the pipe, making a complete seal.
- H. Finish with aluminum jacketing as specified.

3.4 FLANGE, VALVE AND FITTING INSULATION

- A. Cover valves and flanges with fabricated segments, fittings with two-piece factory molded fittings, and both of matching pipe insulation type and thickness equal to that of the adjoining pipe. Fittings and fabricated segments shall be securely held in place.
 - 1. Apply a tack coat of insulating coating/mastic to the insulated fitting to produce a smooth surface.
 - 2. After mastic is dry, apply a second coat of vapor barrier coating/mastic. Neatly embed with 10 x 10 fiberglass or polyester reinforcing mesh into the tack coat.
 - 3. Overlap coating/mastic and fiberglass/polyester reinforcing mesh by 2” on adjoining sections of pipe insulation.
 - 4. Apply a second coat of coating/mastic over the fiberglass/polyester reinforcing mesh to present a smooth surface.
 - 5. Apply coating/mastic to a wet film thickness of 3/64”.
 - 6. Fabric shall not be visible after completion.
 - 7. Vapor seal flanges, valves and fittings with Childers CP-38 or Foster 30-80. Coating must meet MIL Spec C-19565C, Type II and be QPL Listed. Permeance shall be 0.013 perms or less at 43 mils dry. Tested at 100°F and 90% RH per ASTM E96.
- B. PVC fitting covers are not acceptable.

3.5 MISCELLANEOUS

- A. Insulate chilled water pumps with closed cell insulation box.
- B. Install materials after piping has been tested and approved.
- C. Apply insulation on clean, dry surfaces only.
- D. Apply weather protective finish on elastomeric insulation installed in non-conditioned spaces. Provide a minimum of three coats.

3.6 INSULATION THICKNESS

<u>INSULATED UNIT</u>	<u>(Inches)</u>
Refrigerant Piping	1-1/2
Chilled Water Piping (through 2” pipe)	1-1/2
Chilled Water Piping (2-1/2” pipe and Larger)	2
Condensate Drains	1
Heating Water Piping 2” Pipe and Larger	2
Heating Water Piping 1-1/2” Pipe and Smaller	1-1/2
Exterior Chilled and Hot Water Piping, 5” Pipe and Larger	2
Exterior Chilled and Hot Water Piping 4” Pipe and Smaller	1-1/2

END OF SECTION

SECTION 23 0800
HVAC SYSTEMS TECHNICAL COMMISSIONING REQUIREMENTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

1.2 SUMMARY

- A. The purpose of this Section is to define responsibilities in the Commissioning Process. Additional system testing is required within individual Specification Sections.
- B. Commissioning requires the participation of the Contractor to ensure that all systems are operating in a manner consistent with the Contract Documents. General Commissioning requirements and coordination are detailed in Division 01. Division 20-25 Contractors shall be familiar with all parts of Division 01 and the Commissioning Plan issued by the Owner's CxA, shall execute all Commissioning responsibilities assigned to them in the Contract Documents and include the cost of Commissioning in the Contract price.
- C. HVAC systems to be commissioned include the following:
 - 1. Chillers
 - 2. Boilers
 - 3. Pumps
 - 4. Air Handling Unit Systems
 - 5. DX Split Systems
 - 6. Air Terminal Units (10% Sampling)
 - 7. Fan Coil Units
 - 8. Exhaust and Supply Fan Systems
 - 9. Fire, Fire/Smoke and Volume Dampers (Review of testing documentation provided by the contractor)
 - 10. HVAC / Building Automation System and Integrations
 - 12. HVAC / Emergency Power Source Integrations
 - 13. HVAC / Life Safety Systems Integrations
- D. The TAB Contractor will perform control sequence verification on each terminal unit shall independently verify each sensor and point and document the results to be included in the Final TAB Report. The CxA will commission 10% of the terminal units once TAB is complete with the CSV and point verification of the terminal units.

1.3 DEFINITIONS

- A. Refer to the General Commissioning Requirements for definitions.

1.4 SUBMITTALS

- A. Contractor shall provide Owner and/or CxA with documentation required for Commissioning Work. At minimum, documentation shall include: Detailed Start-up procedures, full sequences of operation, Operating and Maintenance data, performance data, control drawings, and details of Owner-contracted tests.
 - 1. Shop drawings and product submittal data related to systems or equipment to be commissioned.
- B. Contractor shall submit to Owner and/or CxA installation and checkout materials actually shipped inside equipment and actual field checkout sheet forms used by factory or field technicians.
- C. Where installation testing may be performed in a progressive manner (i.e., piping hydrostatic testing, ductwork pressure testing, etc.), the Contractor shall prepare and submit to the Owner, A/E team and CxA a testing plan that details how the progressive

- testing will be performed, documented and presented for approval prior to the start of any testing activities.
- D. Contractor shall provide any additional documentation needed to complete the requirements of the Commissioning Process
1. Factory Performance Test Reports: Review and compile all factory performance data to assure that the data is complete prior to executing the FPTs.
 2. Installation testing reports such as ductwork pressure testing, piping hydrostatic testing, piping chemical treatment and flushing, bolt flange torquing, and any documentation associated with local code authority inspections or authorizations.
 3. Completed equipment Start-up certification forms along with the manufacturer's field or factory performance and Start-up test documentation.
 4. Operating and Maintenance (O&M) information per requirements of the Technical Specifications and Division 01 requirements.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials and installation shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
- B. Refer to the General Commissioning Requirements for other work products related to the Commissioning Process
- C. Contractor is required to follow all applicable industry and site specific safety practices, lockout / tagout requirements, specialized PPE requirements, and provide qualified, trained personnel to execute Commissioning Process requirements.

2.2 TEST EQUIPMENT

- A. Contractor shall provide all specialized tools, test equipment and instruments required to execute Start-up, checkout, and testing of equipment.
- B. All specialized tools, test equipment, and instruments required to execute Start-up, checkout, and testing of equipment shall be of sufficient quality and accuracy to test and/or measure system performance within specified tolerances. A testing laboratory must have calibrated test equipment within the previous twelve (12) months. Calibration shall be NIST traceable. Contractor must calibrate test equipment and instruments according to manufacturer's recommended intervals and whenever the test equipment is dropped or damaged. Calibration tags must be affixed to the test equipment or certificates readily available.

PART 3- EXECUTION

3.1 CONSTRUCTION PHASE

- A. In each purchase order or subcontract that is written for changes in scope, include the appropriate requirements for submittal data, Commissioning documentation, testing assistance, Operating and Maintenance (O&M) data, and training, as a minimum.
- B. Attend Pre-Commissioning Meeting(s), Pre-Installation Meeting(s), and other Project meetings scheduled by the Owner, CxA or Contractor to facilitate the Commissioning process.
- C. Provide manufacturer's data sheets and shop drawing submittals of equipment.
- D. Provide additional requested documentation to the Owner and/or CxA, prior to O&M manual submittals, for development of System Verification Checklists and Functional Performance Testing procedures.
 1. Typically, this will include detailed manufacturer's installation and Start-up, operating, troubleshooting and maintenance procedures, full details of any Owner-contracted tests, full factory testing reports, if any, and full warranty information.
 2. In addition, the installation, Start-up, and checkout materials that are actually

shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Contractor and/or CxA.

3. This information and data request may be made prior to normal submittals.
- E. With input from the BAS vendor and A/E, clarify the operation and control of commissioned equipment in areas where the Specifications, BAS control drawings, or equipment documentation are not sufficient for writing detailed test procedures.
- F. During the installation, Start-up and initial checkout process, execute and document related portions of the System Verification Checklists for all commissioned equipment according to the procedures indicated in the Commissioning Plan.
- G. Factory Start-ups: Factory Start-ups are specified for certain equipment. Factory Start-ups generally are Start-up related activities that will be reviewed and checked prior to Functional Performance Tests. All costs associated with factory Start-ups shall be included with the contract price unless otherwise noted. Notify the Commissioning Team of the factory Start-up schedule and coordinate these factory Start-ups with witnessing parties. The Commissioning Team members may witness these Start-ups at their discretion.
- H. Independent Testing Agencies: For systems that specify testing by an independent testing agency, the cost of the test shall be included in the Contract price unless otherwise noted. Testing performed by independent agencies may cover aspects required in the System Verification Checklists, Start-ups, and Functional Performance Tests. Coordinate with the independent testing agency so that CxA, Owner and/or A/E can witness the test to ensure that applicable aspects of the test meet requirements.
- I. Incorporate manufacturer's Start-up procedures with System Verification Checklists (SVC).
- J. Air and water test, adjust and balance shall be completed with discrepancies and problems remedied before Functional Performance Tests of the respective air or water related systems are executed.
- K. Provide skilled technicians to execute starting of equipment and to assist in execution of Functional Performance Tests. Ensure that they are available and present during the agreed-upon schedules and for a sufficient duration to complete the necessary tests, adjustments, and problem solving.
- L. Correct deficiencies (differences between specified and observed performance) as interpreted by the Owner's Project Manager and A/E and retest the system and equipment.
- M. During construction, maintain as-built marked-up Drawings and Specifications of all Contract Documents and Contractor-generated coordination Drawings. Update after completion of Commissioning activities (include deferred tests).
- N. Provide training of the Owner's operating personnel as specified.
- O. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.

3.2 WARRANTY PHASE

- A. Execute seasonal or deferred tests, witnessed by the CxA and Owner, according to the Specifications.
 1. Complete deferred tests as part of this Contract during the Warranty Period. Schedule this activity with the Owner.
- B. Correct deficiencies and make necessary adjustments to O&M manuals, Commissioning documentation, and as-built drawings for applicable issues identified in any deferred or seasonal testing.

3.3 INSTALLATION

- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having

- jurisdiction.
- B. All installation shall be in accordance with the Project Documents.

3.4 TRAINING

- A. Refer to the individual section of this Specification for specific training requirements on each system.
- B. Refer to the General Commissioning Requirements and Division 01 for overall training requirements related to the Commissioning process and this project.

END OF SECTION

SECTION 23 0933
BUILDING MANAGEMENT AND CONTROL SYSTEM

PART 1 - GENERAL

1.1 SCOPE

- A. **Cy-Ranch High School** - The existing campus is controlled by an Automated Logic Control system installed by ALC Houston. All new equipment and modifications to existing systems shall be fully integrated into the existing control system including new graphics for all new equipment and is a part of this scope. Upon completion of this projects the resulting control system shall have all new controllers for the systems being replaced or added including sensors, valves, dampers, valve and damper operators, DDC panels, relays, terminal equipment controllers, mounting brackets and thermowell, etc. Integrate all components to provide a complete and functioning system.
- B. Temperature Control System components:
 - 1. Electronic instruments as specified
 - 2. Electric instruments as specified
 - 3. Microcomputer instruments as specified
- C. All control devices of the same type product shall be of a single manufacturer.
- D. Control, power and interlock wiring necessary to accomplish sequences specified in this Section shall be provided and installed by the Control Subcontractor. Materials and methods of execution as specified in Division 26, Electrical.
 - 1. Coordinate current characteristics of all electrical instruments and equipment with Division 26 of the specifications and related electrical drawings.
- E. The entire Building Management and Control System (BMCS) shall be installed by the Automation System Manufacturer or Authorized Distributor.
 - 1. All components and elements
 - 2. The testing and acceptance procedure
- F. The manufacturer of the building automation system shall provide documentation supporting compliance with ISO-9002 (Model for Quality Assurance in Production, Installation, and Servicing). The intent of this specification requirement is to ensure that the products from the manufacturer are delivered through a Quality System and Framework that will assure consistency in the products delivered for this project.
- G. The entire Building Management and Control System (BMCS) shall be installed, Commissioned, and tested; all performed by the Automation System Manufacturer or Authorized Distributor if approved by engineer.
 - 1. All components and elements.
 - 2. Start-up and point verification.
 - 3. The testing and acceptance procedure.
- H. **The cost of the work specified in this section is included in an allowance.**
 - 1. **Selection of subcontractor will be determined at a future date.**

1.2 RELATED WORK

- A. Division 23, Mechanical
- B. Division 26, Electrical

1.3 SUBMITTALS

- A. Submit items of the Building Management and Control System (BMCS).
 - 1. Temperature control equipment & Field devices.
 - 2. Wiring & Flow diagrams.
 - 3. Sequence of operation.
 - 4. Complete, detailed, control and interlock-wiring diagram.
 - 5. Indicate mechanical and electrical equipment furnished and electrical interlocks, indicating terminal designation of equipment. Respective equipment

manufacturers shall furnish through the Mechanical Contractor, approved drawings of equipment to be incorporated in this diagram.

6. Submit Input / Output summary of all points.
7. Submit an outline of testing procedures from section Testing and Acceptance.
8. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: "Comply", "Do Not Comply", or "Not Applicable". Explain all "Do Not Comply" statements.
9. Submit sample of space temperature sensor and guards for review prior to purchase or installation.

1.4 COOPERATION WITH OTHER TRADES

- A. Furnish control valves, temperature sensing element wells, flow and pressure sensing devices, dampers and other similar devices to the Mechanical Contractor in a timely manner for installation under the Building Management and Control System (BMCS), Subcontractor's supervision.

1.5 METERING AND VERIFICATION REQUIREMENTS

- A. This project is a CHPS applicant. Granular data, derived from the BAS and inherent to this specification, is to be handled in such a way as to support this certification. Granular data is defined as temperatures, set points, run times and utility monitoring. This data is to be monitored on a fifteen-minute interval basis and stored in the BAS database. The BAS must have the inherent capability to trend and display all information as described below.
- B. Monitoring software must include outside environmental condition data which affect building performance. Heating degree days and cooling degree days must be logged and formatted in such a way that the data may be used for comparative analysis of multiple facilities, this facility and any CyFair ISD facility on a historical basis over time. This data must be imported from a reliable, certified, third party source. On site instrumentation is not acceptable.
- C. Metering and Verification requirements must be inherent to the BAS. It cannot be a "bolt on" product. It shall be of no extra cost to the project. It shall be easily accessible from the graphical interface on the main screens. It shall also be accessible from the BAS navigation tree. Data must be retrieved and stored in the BAS module until it is archived on the BAS server. Data acquisition and storage must continue even if communication to the facility is lost. Data for utility consumption and environmental indexing must be stored on the server for a minimum of two years.
- D. All data described in this section shall be easily extractable, without external software or programming.

1.6 WARRANTY

- A. Provide with a manufacturer's parts and labor warranty for a period of two years from substantial completion. Warranty shall include unlimited telephone technical support during the warranty period.
- B. Provide DDC controllers with a manufacturer's parts and labor warranty for a period of 5 years from substantial completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Automated Logic Branch Office – WebCTRL

2.2 SYSTEM ARCHITECTURE

- A. The Building Management and Control System (BMCS) shall consist of an information-sharing network of stand-alone Direct Digital Control Panels (DDCP) to monitor and

control equipment as specified of the control sequence and input/output summary.

- B. "Information sharing" shall be defined as: The function of each DDCP to exchange data on the network trunk with other DDCP's without the need for additional devices such as network managers, gateways or central computers.
- C. "Stand-alone" shall be defined as: The function of each DDCP to independently monitor and control connected equipment through its own microcomputer.

2.3 COMMUNICATIONS PROCESSING

- A. The BMCS shall operate as a true token-pass peer-to-peer communication network. Resident processors in each DDCP shall provide for full exchange of system data between other DDCP's on the network trunk. Systems that limit data exchange to a defined number of system points are not acceptable.
- B. Systems that operate via polled response or other types of protocols that rely on a central processor or similar device to manage DDCP to DDCP communications may be considered only if a similar device is provided as a stand-by. Upon a failure of malfunction of the primary device, the stand-by shall automatically, without any operator intervention, assume all BMCS network management activities.
- C. The failure of any DDCP on the network shall not affect the operation of other DDCP's. All DDCP failure shall be annunciated at the specified alarm printers and terminals.
- D. Network shall support a minimum communications speed of 115.2 Kbps.
- E. The network shall support a minimum of 100 DDC controllers and PC workstations.
- F. Each PC workstation shall support a minimum of 4 peer-to-peer networks, either by hardwired connection or dial up.
- G. The system shall support integration of third party systems (fire alarm, security, lighting, PCL, chiller, boiler) via panel mounted open protocol processor. This processor shall exchange data between the two systems for inter-process control. All exchange points shall have full system functionality as specified herein for hardwired points. Provide examples of 5 reference projects utilizing gateways required for this project.

2.4 DDCP HARDWARE

- A. Each DDCP shall consist of a 32-bit microprocessor and controller, power supply, input / output boards and communication board. All program and point databases shall be stored in battery-backed RAM. Provide a minimum of 1.2 MEG RAM in each DDCP to allow for point expansion and trend data storage.
- B. Each DDCP shall incorporate a real-time clock.
- C. Each DDCP shall be provided with two RS232 communications port. Connecting an operator terminal, whether portable or stationery, shall allow the user to communicate with the entire network.
- D. Each DDCP shall provide for input / output connections to field equipment. The following point types shall be supported:
 - 1. Analog inputs - for measuring sensed variables. Inputs shall be capable of accepting voltage, resistance, current or pressure signals.
 - 2. Analog outputs - for controlling end devices. Outputs shall be capable of producing voltage, resistance, current or pressure signals. Pneumatic outputs shall be provided with a manual override for adjusting outputs in the event of a power loss at the DDCP.
 - 3. Digital inputs - for monitoring dry contacts such as relays, switches, pulses, etc.
 - 4. Digital outputs - to control two position devices such as starters, actuators, relays, etc.
- E. Each DDCP shall be listed under UL916 (Energy Management Systems), and shall be tested to comply with sub-part J of Part 15 FCC rules for Class A computing equipment.
- F. Each DDC Controller shall have sufficient memory to support its own operating system

and databases, including:

1. Control processes
 2. Energy management applications
 3. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
 4. Historical/trend data for points specified
 5. Maintenance support applications
 6. Custom processes
 7. Operator I/O
 8. Dial-up communications
 9. Manual override monitoring
- G. Operator shall have the ability to manually override automatic or centrally executed commands at the DDC Controller via local, point discrete, on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points.
1. Switches shall be mounted either within the DDC Controllers key-accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides.
 2. DDC Controllers shall monitor the status of all overrides and inform the operator that automatic control has been inhibited. DDC Controllers shall also collect override activity information for reports.
 3. **All BMCS control modules shall have Hand Off Auto (HOA) switches on all outputs for HVAC and electrical, including digital outputs.**
- H. DDC Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Graduated intensity LEDs or analog indication of value shall also be provided for each analog output. Status indication shall be visible without opening the panel door.
- I. In the event of the loss of normal power, there shall be an orderly shutdown of all DDC Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.
1. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.
 2. Should DDC Controller memory be lost for any reason, the user shall have the capability of reloading the DDC Controller via the local RS-232C port, via telephone line dial-in or from a network workstation PC.
 3. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.

2.5 PROGRAMMING FUNCTIONS

- A. Resident software in each DDCP shall provide custom programming of control strategies.
1. Point database
 2. Operator interface
 3. Network communications
 4. Facilities and energy management functions
- B. Programming of control and energy management strategies shall be accomplished via a high-level computer language such as BASIC, JC BASIC, C, or Powers Process Control Language. A standard math processor shall be part of the programming language. All analog loops shall be capable of proportional, integral and derivative control.
- C. Each DDCP shall incorporate an operator interface program (OIP) that provides an English language user interface. The OIP shall allow the user to program, interrogate, command and edit the BMCS via a self-prompting method. Operator terminals, whether

textual or graphical, shall be able to access the entire network from any DDCP. Access shall be accomplished in a transparent fashion; that is, the operator shall not be required to address specific DDCP's in order to display or command system points.

2.6 FACILITY MANAGEMENT SOFTWARE

- A. The BMCS shall be provided with standard and custom report generation functions that include:
 - 1. Alarm summaries
 - 2. Motor status summaries
 - 3. Point displays by type, system, status, overrides, failures, location, equipment and enabled/disabled.
 - 4. Program listings
- B. All reports shall be either displayed or printed by:
 - 1. Operator request.
 - 2. Time of day.
 - 3. Event conditions (such as in response to an alarm, interlock, etc.).
- C. All reports shall be time and date stamped.
- D. An alarm-processing program shall be provided to annunciate those points designated as alarmable. Alarm points shall, upon alarm occurrence, be displayed or printed at designated terminals.
- E. Historical trend data shall be collected and stored at each DDCP for later retrieval. Retrieval shall be manual or automatic. Any point, physical or calculated, may be designated for trending. The system shall allow for two methods of trend collection: Either by a pre-defined time interval sample or upon a pre-defined change of value. Trend data shall be presented in a columnar format. Each sample shall be timed stamped. Trend reports may be a single point or may be a group of points, up to a maximum of (8) points in any single group. Any point, regardless of physical location in the system may become part of a multiple point group.
- F. Each BMCS network shall provide a point-monitoring function that can display single or multiple points in a continuous updated fashion for dynamic displays of point values.
- G. A database and configuration report program shall be provided that allows the user to interrogate BMCS status. As a minimum, the user shall be able to: Verify available RAM at each DDCP, verify DDCP status (on-line, off-line, and failed) and set the system clock.
- H. Any invalid operator entry shall result in an error message.
- I. DDCP's shall contain a password access routine that will assign an operator to one of three level of access. Level 1 shall permit display function only, level 2 shall additionally permit commanding of system points and level 3 shall additionally permit full program and database editing.
- J. DDCP's shall provide for the accumulation of totalized values for the purposes of run-time or energy totalization. Totalized values may be displayed or printed automatically or by operator request.

2.7 ENERGY MANAGEMENT SOFTWARE

- A. The BMCS shall be provided with an optimal start program such that the building may be divided into ten zones for optimum start. Warm-up and cool-down shall occur in sequence with succeeding zones starting only after the preceding zone has completed its warm-up or cool-down.
 - 1. The optimum start-up time of assigned equipment shall be determined based on a software calculation that takes into consideration outdoor air conditions, space conditions, and building thermal characteristics ("U" factor).
 - 2. The optimum start program shall control start-up of the cooling and heating equipment to achieve the target occupancy space temperature at the precise time of building occupancy.

3. A built-in "learning" technique shall cause the BMCS to automatically adjust itself to the most effective time to start equipment based on historical data.
- B. The BMCS shall be provided with an operator interactive time of day (TOD) program. TOD programming and modifying shall be accomplished in a calendar-like format that prompts the user in English language to specify month, year, day and time and associated point commands. It shall be possible to assign single points or groups of points to any on or off time. Appropriate time delays shall be provided to "stagger" on times.
 1. TOD shall incorporate a holiday and special day schedule capability, which will automatically bring up a pre-defined holiday or special day schedule of operation. Holidays or special days can be scheduled up to one year in advance.
 2. In addition to the time dependent two-state control, TOD also provides time dependent setpoint control. This control provides the capability to output assignable, proportional setpoint values in accordance with the time of day and day of week. This program shall be used to accomplish night setback, morning warm-up and normal daily operating setpoints of all control system loops controlled by the BMCS. As with the two-state control, time dependent setpoint control shall be subject to the holiday schedule. The setpoints desired shall be user definable at any operator terminal.
 3. The operator shall be capable of reading and/or altering all sorted data pertaining to time of day, day of week, on/off times, setpoint values, and holiday designation.
 4. The TOD program shall also provide an override function that allows the user to conveniently change a start or stop time for any point up to one week in advance. The override command shall be temporary. Once executed the TOD program shall revert to its original schedule.
 5. The TOD program shall interface with the optimal start program (OSP) such that stop times may be assigned by OSP.
- C. Additional Program functions required are to be installed and programmed as requested by end user at no additional cost:
 1. Enthalpy optimization.
 2. Supply air reset.
 3. Hot water reset.
 4. Chilled water reset.
 5. Volumetric control.
 6. Dead band control. Install dual set points as requested by user.
 7. All specified energy management programs, whether or not applicable to this project shall be provided such that the owner may enable the program at a future date without the need to purchase additional software or modify existing software.
 8. Time lapse graphics
 9. Global point commands

2.8 WEB SERVER ACCESSIBILITY

- A. Industry leading encryption technology to provide accessibility through a web browser.
- B. Building Manager's ability to access, view and command critical building information in real time over the intranet or internet.
 1. Alarm Display
 2. Point Commanding
 3. Graphic Display
 4. Scheduling
 5. Running Reports
 6. Point Details

2.9 REMOTE NOTIFICATION

- A. Remote notification sends Alarm and System Event information to various notification devices as indicated below but not limited to. Operators can receive their building automation system alarms without restricting them to dedicated workstations.
 - 1. Alphanumeric pagers
 - 2. Numeric pagers
 - 3. Email
 - 4. Phones via voice or short message service (SMS) Text Messaging

2.10 POINT EXPANSION MODULES

- A. Capable of extending its input/output capabilities via special purpose modules.
 - 1. Modules may be mounted remote from the DDCP.
 - 2. Shall communicate with the DDCP over a pair of twisted cables.
 - 3. Operator shall have the ability to manually override automatic or centrally executed commands at the DDC Controller via local, point discrete, on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points.
 - 4. **All BMCS control modules shall have Hand Off Auto (HOA) switches on all outputs for HVAC and electrical, including digital outputs.**

2.11 TERMINAL EQUIPMENT CONTROLLERS

- A. Provide for control of each piece of equipment, including, but not limited to, the following:
 - 1. Variable Air Volume (VAV) boxes
 - 2. Constant Air Volume (CAV) boxes
 - 3. Dual Duct Terminal Boxes
 - 4. Unit Conditioners
 - 5. Variable Refrigerant Volume DX System
 - 6. 100% Outside Air Split System
 - 7. Room Pressurization
 - 8. Fan Coil Units
- B. Include the following items:
 - 1. All input and outputs necessary to perform the specified control sequences.
 - a. Analog outputs shall be industry standard signals such as 24V floating control.
 - 2. Sufficient memory to accommodate point database, operating programs, local alarming and local trending.
 - 3. All databases and programs shall be stored in non-volatile EEPROM, EPROM and PROM, or minimum of 100-hour battery backup shall be provided.
 - 4. Return to full normal operation without user intervention after a power outage of unlimited duration.
 - 5. Operation programs shall be field selectable for specific applications.
 - 6. Specific control strategy requirements, allowing for additional system flexibility.
 - 7. Controllers that require factory changes of all applications are not acceptable.

2.12 ELECTRONIC DAMPER ACTUATORS

- A. Two position damper operators:
 - 1. Spring return to full travel position.
 - 2. Built in auxiliary switches (motor end switches)
 - a. Switch shall be fully adjustable so that cut-in/cut-out points may be preset at any point within angular travel of the motor.
 - 3. Minimum torque 60-in-lb
- B. Modulating damper operators:

1. Sized with sufficient reserve power to provide smooth modulating action and tight close off against the system pressure
2. Select the operator with available torque to exceed the maximum required operating torque by not less than 50%
3. Minimum torque 100 in-lb

2.13 ETHERNET CARD

- A. Ethernet Card:
1. Local area network connection interface card.

2.14 CONTROL CABINETS

- A. Fully enclosed NEMA 1 for indoors, NEMA 4 for outdoors.
1. Powder coat painted on all sides
 2. Cabinet with continuously piano type hinged door
 3. Locking latch
 4. All locks shall use a common key
 5. Devices on the panel face must be identified with engraved nameplates.
 6. Panels or termination panels must be identified with engraved nameplates.
 7. Provide enamel beige finish and extruded aluminum alloy frame UL 50 certified.

2.15 AUTOMATIC CONTROL VALVES

- A. Pressure ratings: Minimum 125 psig or 1.25 times maximum system operating pressure.
- B. Construction:
1. 2" and smaller:
 - a. Screwed.
 - b. Bodies and internal parts: Bronze, stainless steel or other approved corrosion-resistant metal.
 2. 2-1/2" and larger:
 - a. Flanged.
 - b. Bodies: Cast iron or cast steel.
 - c. Seats and parts exposed to fluid: Bronze, stainless steel or other approved corrosion-resistant metal.
 3. Characterized port ball valves are acceptable for VAV terminal units only.
- C. Modulating straight through water valves: Equal percentage contoured throttling plugs.
- D. Three Way Mixing Valves: Linear throttling plugs allowing total flow through valve to remain constant regardless of position.
- E. Sizes: By Automatic Control System Manufacturer for fully modulating operation.
1. Minimum pressure drop: Equal to pressure drop of coil or exchanger.
 2. Maximum pressure drop: 5.5 psi.
 3. Relief and bypass valves: Sized according to pressure available.
 4. 2-position valves: Line size.
 5. Manual by-pass operator.
- F. Electronic Actuator:
1. Direct coupled installation
 2. Visual and electronic stroke indicator
 3. Die-cast aluminum housing
 4. Manual override
 5. Self-lubricating bearing and gear train
 6. Automatic calibration
 7. Automatic duty cycle protection
 8. Overload and stall protection
 9. Non-spring return
 10. Floating /0-10 VAC / 4-20mA operation

11. UL approved
 12. Provide smooth modulating action and tight close off against the system pressure.
 13. Torque to exceed the maximum required operating torque by not less than 50%.
 14. Actuator input signal shall be compatible with output DDC controller.
 15. Provide weatherproof enclosure (exterior use).
 16. Damper actuators not acceptable for valves.
- G. Cooling Tower By-Pass and Chiller / Cooling Tower Isolation Valves & Actuators:
1. Valve Bray (Series 3L or NYL)
 - a. Line Size Valve
 - b. Under-cut disk for smooth operation
 - c. Full Lug Valve
 - d. Cast Iron Body
 - e. EPDM - Seat
 - f. 416 Stainless Steel Stem
 - g. Nylon Coated Ductile Iron Disc
 - h. Disc-to-stem connection shall utilize a double “D” or key design requiring no screws or pins to connect stem to disc.
 2. Electronic Actuator: Bray (Series 70)
 - a. Fully configurable without need for software or handheld settings device
 - b. Direct Mount
 - c. Solid state speed control
 - d. Visual and electronic stroke indicator.
 - e. Anti-Condensation Heater (exterior actuators)
 - f. Die-cast aluminum housing.
 - g. Manual override by means of hand wheel
 - h. Self-lubricating bearing and gear train.
 - i. All steel self-locking output gearing to be provided
 - j. Continuous Duty Rated Motor
 - k. Overload and stall protection.
 - l. Floating /0-10 VAC / 4-20mA operation.
 - m. Mechanical Travel stops
 - n. UL approved.
 - o. Smooth modulating action.
 - p. Tight close off against the system pressure.
 - q. Sized to exceed 150% of the maximum required operating torque of the valve while under the maximum rated shut-off pressure
 - r. Actuator input signal shall be compatible with output DDC controller.
 - s. Provide weatherproof enclosure
 - t. Damper actuators not acceptable for valves.
- H. Variable Primary Flow By-Pass Control Valve:
1. Modulating straight through control valve with equal percentage contoured throttling plug and electronic operator.
 2. Maximum pressure drop: 10 psi
 3. Sized for minimum flow of one chiller
 4. Torque to exceed the maximum required operating torque by not less than 150%.

2.18 DIFFERENTIAL PRESSURE SWITCHES

- A. Wet/wet differential pressure switch
1. Integral Mounting Frame
 2. Watertight, dust-tight, and corrosion resistant enclosure.
 3. Wetted materials of brass and fluoroelastomer.
 4. Externally adjustable set point
-

- B. Approved manufacturer:
 - 1. Square D #9012GGW4
 - 2. Dwyer #DXW-11-153-1
 - 3. Carrier #HK06ZC033

2.19 TEMPERATURE LOW LIMIT SWITCH

- A. Responsive to the coldest 1' section of its length.
 - 1. Double pole single throw switch
 - 2. 20' capillary
 - 3. Line voltage with bellows actuated switch
 - 4. Auto reset for outdoor installation
 - 5. Manual reset for indoor installation

2.20 TEMPERATURE AND HUMIDITY SENSORS

- A. Space Temperature Sensors
 - 1. Thermistor with resistance of 10,000 ohms at 77°F.
 - 2. Accuracy shall be +/-1/2°F.
 - 3. Range of 45° to 95° F operating range.
 - 4. Provide manufacturers calibration certificate.
 - 5. Flush Mounted
 - a. Stainless steel flush mount sensor, submit sample for review.
 - 6. Location and height to be approved by Architect/Engineer prior to installation.
- B. Space / Duct Humidity Sensor
 - 1. Capacitance element in the space or duct as required and output a 4 to 20 MA signal proportional to 0 to 100% RH to the DDC.
 - 2. Capacitance element shall be field replaceable and not require calibration.
 - 3. Accuracy shall be +/-2% in the range from 20 to 95% RH.
 - 4. Relative humidity sensors shall have the sensing element of inorganic resistance media.
 - 5. Provide locking metal covers suitable for institutional use. Submit sample for review.
 - 6. Provide manufacturers calibration certificate.
 - 7. Provide metal guards in the following locations:
 - a. Corridors
 - b. Cafeteria
 - c. Kitchen.
 - d. Gymnasium.
 - e. Dressing Rooms.
 - f. Industrial Labs.
- C. Duct Temperature Sensors
 - 1. Range of 20° to 120°F.
 - 2. Single point sensing of temperature.
 - 3. Averaging elements of sufficient length to sense temperature across 2/3 duct width.
 - 4. Averaging elements of sufficient length to provide accurate, representative indication and control.
 - 5. Averaging elements of sufficient length to prevent variances in temperature or stratification.
- D. Liquid Immersion Temperature Sensors
 - 1. Platinum type resistance temperature detector (RTD).
 - 2. Match sensor range to medium being monitored.
 - a. Hot water range 30° to 250°F.
 - b. Chilled Water 20° to 70°F.

3. Furnish stainless steel wells for installation by Mechanical Contractor.
4. Locate all sensors in field with Owner/Engineer present.
5. System accuracy for liquid temperature sensing shall be +/-1/2°.
6. Sensors must be removable from wells.
- E. Outside Air Temperature and Humidity Sensor
 1. Temperature
 - a. Range of -40° to 140°F.
 - b. Accuracy shall be +/-0.9°F
 - c. Encapsulated into Type 304 stainless steel tubes with low conductivity moisture proofing material and lag extension for thickness of insulation.
 2. Humidity
 - a. Capacitance element in the space or duct as required and output a 4 to 20 MA signal proportional to 0 to 100% RH to the DDC.
 - b. Accuracy shall be +/-2%
 - c. Range from 20 to 95% RH.
 - d. Relative humidity sensors shall have the sensing element of inorganic resistance media.
 3. Weatherproof sun shield consisting of multiple white plastic plates to reduce the thermal effects of the sun and increasing air flow between the plates.
 4. Sensor shall be mounted a minimum of 6" from all building structures.
 5. Minimum of 8' long leads.
 6. Provide manufacturers calibration certificate.
 7. Provide with a 5-year warranty
 8. Manufactured by ACI Model # A/-RH2-AN-O-SUN---NIST
- F. Freezer / Cooler Sensors
 1. Thermistor with resistance of 10,000 ohms at 77°F.
 2. Accuracy shall be +/-1/2°F.
 3. Range of -40°F to 210°F.
 4. Provide manufacturers calibration certificate.
 2. Die cast aluminum construction
 3. Liquid tight wire connector to isolate sensor chamber from exterior temperature influence.
 4. 1/2" NPT threaded hub
 5. Mamac Systems Model #TE-205-F-12
 6. Reuse existing wiring penetrations through cooler or freezer where possible. If existing penetrations through cooler or freezers cannot be reused, seal existing holes with silicon such that opening is airtight.
 7. All new penetrations into the cooler or freezer body shall be sealed airtight using silicon. This shall include screw holes and wiring penetrations.

2.21 CURRENT SENSITIVE RELAYS

- A. Ensure compatibility with VFD applications for variable speed motor status.
 1. Provide with adjustable set point.
 2. Relays must be mounted and not hung by power wires thru CT.
 3. Provide split-core type current sensors.
 4. Loop powered.
 5. LED Status.
 6. Acceptable Manufacturer: Veris Industries / Hawkeye
 7. Relays shall close status contacts in response to current flow in power leads to the equipment being monitored.
 8. To be used on towers, vertical turbine pumps, exhaust fans and direct drive equipment only.

2.22 DIFFERENTIAL PRESSURE TRANSDUCER

- A. Transducers to convert differential pressures to 4-20 MA analog outputs.
 - 1. Solid state pressure sensor with accuracy of +/- 1% of calibration range.
 - 2. Factory calibrated and have zero and span trimmers for field calibration.
 - 3. Range shall be selected to match the medium being monitored.
 - 4. Pressure snubbers to protect from pressure pulses and a 3-way bypass / valve assembly to protect the transducer from overpressure damage during start-up.
 - 5. LCD Display
 - 6. Acceptable Manufacturer: Rosemount 1151 or 3051 Pressure Transmitter

2.23 FLOW DIFFERENTIAL PRESSURE SWITCH

- A. The pressure sensing element shall be of the convoluted diaphragm type for sensitivity to system differential pressure.
 - 1. Select the pressure range based on the sensed differential pressure.
 - 2. The unit shall be protected against overpressure to the full static pressure rating.
 - 3. Accuracy: +/- 2% of full scale.
- B. Switch assembly.
 - 1. Reed switch.
 - 2. NEMA-4 enclosure.
 - 3. Threaded boss conduit entrance.
 - 4. SPST action.
 - 5. Voltage and rating as required for the control circuit.
- C. Wetted parts shall be made of type 303 stainless steel.
- D. Install an isolation valve in each sensing pipe leg to permit servicing without shutting the system down.

2.24 ELECTRIC REMOTE BULB THERMOSTAT

- A. Two position remote bulb thermostat:
 - 1. Bimetal controlled.
 - 2. Sealed mercury switches.
 - 3. Provide specified control action.
 - 4. Adjustment can be made by removing unit cover.
 - 5. Element with capillary length as required for the location.

2.25 ELECTRIC SPACE THERMOSTAT

- A. Two position space thermostat.
 - 1. Single Pole switch actuated by bi-metal sensing element.
 - 2. Range shall be 60°F to 90°F.
 - 3. Removable external knob adjustment means.

2.26 HIGH STATIC PRESSURE SWITCH

- A. With manual reset switch
 - 1. Approved manufacturer: Cleveland AFS-460.

2.27 INSERTION FLOW SENSORS

- A. Electromagnetic Flow Meter
 - 1. Retractable hot tap flow sensor
 - 2. Accuracy: +/- 1% of full scale
 - 3. Electromagnetic
 - 4. Custom thread-o-let 400 psi / 250 degree F rated.
 - 5. Line size from 1-1/4 to 72 inch
 - 6. Metering range from 0.3 to 15 f/sec.
 - 7. Remote NEMA 4 wall mounted LCD display

8. Field Pro Software & Communicator
9. Warranty two years
10. Approved Manufacturer Onicon Flow Meter F3500 or FT3500

2.28 CONTROL DAMPERS

- A. Opposed blade dampers:
1. Frames of 13-gauge galvanized sheet metal.
 2. Provisions for duct mounting.
 3. Damper blades not exceeding 8" in width.
 4. Blades of two sheets of 16-gauge galvanized sheet metal.
 5. Blades suitable for high velocity performance.
 6. Bearings of nylon or oil-impregnated, sintered bronze.
 7. Shafts of 1/2" zinc plated steel
 8. Leakage does not exceed 1/2% based on 2000 fpm and 4" static pressure.
 9. Replaceable resilient seals along top, bottom and sides of frame and blade edge.
 10. Submit leakage and flow characteristics data with shop drawings.
 11. Linkage shall be concealed out of the air stream within damper frame.
 12. Acceptable Model is Ruskin Model CD60.

2.29 PHOTO CELL CONTROL

- A. Light Sensitive Resistor:
1. 4-20 output or switch
 2. On = 3.0 / fc. Off 10.0 / fc
 3. UL Approved

2.30 DRAIN PAN FLOAT SWITCH

- A. Rated at 10 Amps:
1. Shuts off equipment if water level becomes too high.
 2. DPDT Contacts.

2.31 BY-PASS AUTOMATIC SHUT-OFF TIMERS

- A. Rated at 10 Amps, 125 VAC:
1. Shuts off equipment with timed switch
 2. White decorated timer
 3. Without hold feature
 4. Time Cycle 60 minutes

2.32 TEMPERATURE/CO₂ SENSOR

- A. Sensor combo in one housing, Temperature and CO₂.
- B. Provide combo temperature/CO₂ sensor in the following locations:
- a. Each Classroom
 - b. Library
 - c. Cafeteria
 - d. Gymnasium
- C. 0-2,000 ppm CO₂
- D. CO₂ sensor shall have a self-calibration feature.
- E. Temperature accuracy shall be +/-1/2°F.
- F. Temperature range shall be 32° to 120° F
- G. Location and height to be approved by Architect/Engineer prior to installation.
- H. Internal RJ11 Communication jack at sensor for communications.
- I. Provide metal guards in the following locations:
- a. Corridors
 - b. Cafeteria

- c. Kitchen.
- d. Gymnasium.
- e. Dressing Rooms.
- f. Industrial Labs.
- J. Color to be approved by Architect / Owner, submit sample for review.

2.33 AIR FLOW SENSING SWITCH

- A. The pressure sensing element shall be of the convoluted diaphragm type for sensitivity to system positive, negative, or differential pressure.
 - 1. Select the pressure range based on the sensed differential pressure.
 - 2. The unit shall be protected against overpressure to the full static pressure rating.
 - 3. Accuracy: +/- 2% of full scale
- B. Switch assembly:
 - 1. Reed switch
 - 2. Field adjustable setpoint
 - 3. Threaded boss conduit entrance
 - 4. SPST Action
 - 5. Voltage and rating as required for the control circuit

2.34 HVAC SHUTDOWN STATION

- A. Shutdown Switch:
 - 1. Yellow Mushroom Button within a clear plastic cover
 - 2. Latches when depressed
 - 3. Twist reset
 - 4. Sign "HVAC SHUTDOWN"
 - 5. Manufactured by STI Model # SS2231HV-EN

PART 3 - EXECUTION

3.2 INSTALLATION

- A. The control system shall be installed and final adjustments made by full-time employees of the factory-approved BMCS Building Management Control Subcontractor.
- B. The contractor shall collaborate through Architect / Engineer and Owner to determine the Owner's preference for naming conventions, etc. before entering the data in to the system.
- C. Due to actual operational or space conditions, it may be necessary for the Contractor to make sequence of operation modifications and/or controller adjustments, change the location or type of sensor to obtain proper operation and coverage of the system in each room or space. These change, if requested by the Owner or Engineer, shall be performed at no additional cost to the Owner. Therefore, labor allowances should be made for such changes and adjustments if requested.
- D. The modification and expansion of the existing control system shall include removing any existing control wiring and devices associated with systems being removed.

3.3 INTERLOCK AND SAFETY CIRCUITS

- A. Close the outdoor air dampers when the related HVAC unit supply or exhaust fan is de-energized:
 - 1. The damper and actuators are specified in this section.
 - 2. Outdoor air damper shall be fully opened before related air handling unit fan is energized for 100% outside air use.
 - 3. Provide motorized outside air dampers for the following:
 - a. Supply fans
 - b. AHUs

- c. Exhaust fans (except kitchen exhaust)
- d. Outside air intakes
- e. Relief air hoods
- B. Close the chilled and hot water valves to the coil when the related unit is de-energized.
- C. Interlock each chiller to start its dedicated chilled and condenser water pumps. Interlock pressure differential switch and pump auxiliary contacts in series to chiller safety terminal strip.
 - 1. On shutdown provide a circuit to permit the chilled water pumps and condenser water pumps to run while the chillers pump down as required by the manufacturer.
 - 2. As per manufacturer's recommendations.
- D. Primary chilled water control:
 - 1. Operating and safety controls are furnished as an integral part of the water-chilling unit and not specified in this section.
 - 2. Provide pressure differential switch located in the chilled water and condenser water piping to each water-cooled liquid chiller.
 - a) Interlock to prevent operation in the absence of flow.
 - b) This may not be the prime controller to start/stop the chiller.
 - c) Interlock thru pump auxiliary contacts.
 - 3. Provide a high limit temperature sensor in each primary chilled water pump loop.
- E. Exhaust/Supply Fans:
 - 1. Interlock the related exhaust and supply fans and the related outside air damper.
 - 2. Interlock the exhaust fans with the related air-handling unit through software. The new BMCS shall integrate all existing fan interlocks.
 - 3. Interlock related exhaust fan for dishwasher with time delay off relay.
 - 4. Interlock related exhaust fan for kiln with time delay off relay
 - 5. Interlock kitchen hood related supply and exhaust fans.
 - 6. Provide additional interlocks as indicated on fan schedule and on drawings.
 - 7. Interlock electrical and mechanical room exhaust fans with thermostat.
 - 8. Interlock refrigerant monitor with mechanical room purge system.
 - 9. Interlock science room related supply and exhaust fans.
 - 10. Interlock outside air supply fans for VAV air-handling unit with air-handling unit status point.
- F. Cooling Tower Fan Safety Interlock: Provide interlock wiring for the vibration sensor and oil level switch on each cooling tower fan.
- G. Freeze Protection:
 - 1. Provide a freeze protection sequence to ensure proper operation of equipment during a freeze condition not limited to the following:
 - a. Outside Air Handling Units & Supply Fans with heating and cooling coils: If unit is in occupied or unoccupied mode, upon the triggering of software point indicating a freeze condition or the low temperature sensor (freeze stat) indicates a freeze condition, the system will be disabled, close the outside air damper, open both heating and cooling valves to enable full flow condition. If heating coil discharge air sensor indicates a failure to control and is below setpoint then enable software point indicating a freeze condition, disable unit, close outside air damper, and open both heating and cooling valves to enable full flow condition. Ensure HW & CHW pumps are operational.
 - b. Boilers - Enable during a freeze condition.
 - c. Air Cooled Chillers – enable pumps, run cycle for 15 minutes per hour, open all chilled water valves.
 - d. Protect heating water coils downstream of DX cooling coil with freeze protection. If unit is in occupied or unoccupied mode, upon the triggering

- of software point indicating a freeze condition or the low temperature sensor (freeze stat) indicates a freeze condition, the system will be disabled, close the outside air damper, disable the DX cooling coil. If heating coil discharge air sensor indicates a failure to control and is below setpoint then enable software point indicating a freeze condition.
2. Temperature low limit switch wired with double pole single throw switch with one switch leg hard-wired to de-energize fan and one switch leg to signal BMCS.
- H. Drain Pan Float Protection:
1. Interlock to shut down unit and close valves.
 2. Cooling Coils mounted above ceiling and in roof mounted units.
 3. Provide for each cooling coil location.
 4. Signal BMCS alarm point
- I. HVAC Shutdown Station:
1. Provide an emergency mushroom style push / pull station shutdown switch in a Administration Area or as directed by Owner / Architect.
 2. Signal the building automation system to de-energize the HVAC equipment.
 3. This is to stop exhaust fans and outside air units immediately.
 4. Other air handling units, chillers and equipment shall be shut down in an orderly manner so as to not damage the equipment.
 5. Once stopped, the system may only be restarted by relatching the emergency push button switch.
- J. Science Room Utility Controllers:
1. Interlock the utility controllers with related air-handling unit through software.
- K. Domestic Water System:
1. Interlock in-line circulating pumps at water heaters with return water pipe mounted thermostat to cycle pump with return water temperature.
 2. Interlock high temperature entering water solenoid valve with thermostat on discharge side of tempered water mixing valves.
- L. Condensing Hot Water Boilers:
1. Interlock each boiler to start its dedicated pump.
 2. Install communication cable between each boiler and master controller specified by boiler manufacturer.

3.4 GRAPHICS

- A. Furnish as-built drawings indicating finally corrected "as installed" diagram(s) of the complete Building Management Control System.
1. Modification of existing control systems shall be included.
 2. These must be as-built and any changes during the warranty period drawings must be revised and updated.
 3. Provide final sequence of operation in written format.
- B. Provide a set of the "as installed" diagram(s) of the complete control system laminated in plastic and hung in the main mechanical room or as directed by Owner.
- C. Provide a color-coded floor plan of the building showing the location of each system, and the area served by each AHU or related zone. These must be of professional quality. Floor plan is to hang in main mechanical room near central control panel.
- D. Provide computer graphics for each system.
- E. Provide final graphic room numbers as selected by District. Any changes during the warranty period shall be included.
- F. Provide a summary page for each type of equipment. Summary pages shall be provided for, but not limited to, DDB, EF, AHU, CH, CT, Pumps, and FCU. Summary pages shall include the ability to modify the global set points for each equipment type.
- G. Provide an alarm management and reporting graphical page. This page shall allow user

- to create, acknowledge and adjust alarms. All alarms shall have the ability to be selectable for remote notifications and control which personnel is notified.
- H. System shall include a graphical page that contains building and system related documents stored for ease of remote access.
 - I. System shall include a real time dynamic dashboard to provide real time analysis of conditions and equipment performance.
 - J. System shall include a real time dynamic Central Plant Energy / Status dashboard. Dashboard shall display the following at a minimum:
 - 1. Actual Plant operating Tons
 - 2. Total Plant Capacity Available
 - 3. Percent Usage of Available Capacity
 - 4. Current Plant operation KW/Ton
 - 5. Current Chiller KW/Ton
 - 6. Bar Chart indicating energy consumption by plant component (Chillers, CW Pumps, CHW Pumps and Exhaust Fans)
 - 7. Tables for Chillers, Chilled Water Pumps, Condenser Water Pumps, and Cooling Tower Fan. The chart shall indicate S/S, Status, KW Consumption, Alarm Status Running AMPS on Chillers.
 - 7. Trending Graph (Total Chiller KW/Ton and Total Plant KW/Ton)
 - K. The modification and expansion of the existing control system shall include removing and updating all graphics to reflect equipment that has been added or removed.

3.5 IDENTIFICATION

- A. Provide a laminated engraved nameplate on all control panels and devices shown on the "as installed" control diagrams. Coordinate engraving with nomenclature used on the diagrams.
- B. A black-white-black laminated plastic engraved identifying nameplate shall be secured to each terminal cabinet, and control panels. Identifying nameplates shall have ½ inch high, engraved letters.

3.6 WIRING FOR BUILDING MANAGEMENT AND CONTROL SYSTEMS

- A. Furnish and install all wire, conduit, raceways and cable systems required for the complete operation of the Building Management and Control System. In addition, furnish, and install all wire, conduit, raceways and cable systems required with the VRF system in the Administration area.
- B. All wiring for the Building Management and Control System is specified in this section and includes, but is not limited to:
 - 1. Wiring of interlock system.
 - 2. Wiring of control instruments.
 - 3. Wiring of control panels.
 - 4. Wiring of related power supplies, i.e. transformers.
 - 5. Wiring of 120 VAC power circuits for control panels and devices.
- C. All materials and methods specified in this section shall comply with the requirements specified in Division 26 of this specification.
- D. All power supply requirements shall be connected to the building electrical distribution system in an approved manner. Do not connect control equipment of circuits common with other building loads or devices.
- E. Temperature control wiring shall be jacketed cables installed with or without conduit as specified below or single conductors installed in conduit. Control wiring shall have minimum 300V insulation for low voltage wiring and 600V insulation for line voltage wiring.
- F. All line voltage control wiring, all low voltage control wiring which is exposed in the central plant, penthouse, and other exposed ceiling spaces; all low voltage control wiring which

- is routed through concealed inaccessible locations shall be installed in conduit.
- G. All low voltage control wiring which is routed through concealed accessible locations may be run without conduit provided that the wiring run without conduit is properly supported from the building structure on maximum 5' centers and does not depend upon the ceiling grid or the ceiling support system for support. Wiring run in plenum spaces shall be plenum rated. Support all plenum wiring in accessible locations in bridge rings, J-hooks, D rings. Plenum wiring is not to be supported within building structure or attached to conduit raceways. All low voltage wiring must be installed through supports. Wires shall be supported on 5' centers and identified at each termination point and at 50' centers minimum. Install wire parallel or perpendicular to the structural features of the building.
 - H. Line and low voltage control wiring shall not be installed in the same conduit with control wiring and shall not be installed in the same conduit with power wiring.
 - I. All wiring associated with building management and control system cover shall be as follows:
 - 1. Sensor jacket color, Green
 - 2. LAN communications, Yellow
 - 3. All THHN wiring shall comply with Division 26 insulation color identification

3.7 EXHAUST AND SUPPLY FANS

- A. Provide interlocks as scheduled on the plans unless shown on the electrical drawings.
- B. Provide BMCS override to disable operation of all exhaust and supply fans interlocked and/or specified throughout project.
- C. Dampers and actuators shall be provided by this contractor and shall not be furnished with the exhaust fan.
- D. Dampers and actuators shall be provided by this contractor and shall not be furnished with the exhaust fan.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
Fan Status	DI	Current Sensitive Relay (EF) Air Flow Sensing Switch (SF)
Outside Air Damper	DO	Electronic Operator

3.8 KILN ROOM CONTROL

- A. This system consists of an exhaust fan and outside air intake. Controls shall be as follows:
 - 1. A line voltage twist time (12 HR w/o hold) shall energize the exhaust fan. The damper on the outside air intake shall interlocked with exhaust fan operation. A space temperature sensor shall, acting through the DDC panel, monitor the space temperature. If the space temperature rises above 130°F (adjustable) for 1 minute (adjustable), the kiln operation shall be disabled and an alarm shall be sent through the BMCS.

POINT DESCRIPTION	TYPES	DEVICE
Fan Start/Stop	DO	Control Relay
Kiln Start/Stop	DO	Control Relay

POINT DESCRIPTION	TYPES	DEVICE
Fan Status	DI	Current Sensitive Relay (EF)
Outside Air Damper	DO	Electronic Operator

3.13 MISCELLANEOUS

- A. MDF/IDF Temperature Sensor: Provide a temperature sensor in each MDF and IDF rooms to monitor space conditions. BMCS shall alarm when temperature is out of setpoint range.

POINT DESCRIPTION	TYPE	DEVICE
MDF/IDF Temperature	AI	Space Sensor

- B. Specialized Storage Rooms: Provide a temperature and humidity sensor in each specialized storage room to monitor space conditions. BMCS shall alarm when temperature and humidity is out of setpoint range.

POINT DESCRIPTION	TYPE	DEVICE
Storage Temperature	AI	Space Temp Sensor
Storage Humidity	AI	Space Humidity Sensor

- C. Outside Air:
- Provide a temperature sensor and humidity sensor to monitor outside air conditions.
 - The BMCS control system shall reference the nearest airport weather data to verify BMCS sensor accuracy by comparing the local sensor readings to the airport conditions. If the values vary by more than 10% (Adjustable) an alarm shall be sent through the BMCS that local sensors are out of range and need to be re-calibrated.

POINT DESCRIPTION	TYPE	DEVICE
Outside Temperature	AI	Thermistor
Outside Humidity	AI	Humidity Sensor

- D. Photocell: Provide a photo sensor mounted on the north side of the building. Location is to be approved by Owner / Architect / Engineer.

POINT DESCRIPTION	TYPE	DEVICE
Photocell	AI	Contact

- E. Interior Lighting Control:
Building Management Control System Scope
 The lighting control system, as indicated on the electrical drawings lighting control details,

will be provided with lighting control system BMCS interface devices via DLM room controllers, refer to Electrical Drawings and Details. The BMCS system shall send a occupied and unoccupied signal to the lighting control system BMCS interface devices based on a BMCS schedule.

The BMCS provider shall provide an additional 8 hours of technician support to ensure the lighting control system is commissioned and operating as described.

Lighting Control System Scope

When the Lighting Control system BMCS interface devices in an area receives an occupied signal from BMCS, the lights in that area shall remain in their current state (typically off) but allow any local switch in that area to control the lighting in that space.

When the Lighting Control system receives an unoccupied signal from BMCS, the lighting control system shall flash the lights, and after a delay, the lights in that area shall be swept off by the lighting control system. In this unoccupied mode, the lighting control system shall allow any local light switch in that area to allow the lights to be controlled locally for 2-hours upon being switched on by the local switch. After the 2-hours, the lighting control system enable signal shall expire, and the lights shall again flash a warning, and if the local switch is not again activated, the lights shall be turned off by the lighting control system.

POINT DESCRIPTION	TYPE	DEVICE
Interior Lighting Control		DLM Room Controller

- F. Exterior Lighting Control
 - 1. Provide individual time/photo-cell and time based control of each lighting contactor specified in Division 26.
 - a. Provide separate control of each contactor.
 - 2. The exterior lights shall be controlled by the BMCS using both a combination of photosensor, time schedules and astronomical sunrise/sunset. The exterior lights shall automatically come on when the sun sets based on the longitude and latitude coordinates of the facility (adjustable +/- 30 minutes). At 11 p.m. (adjustable) the time schedule shall turn off the exterior lights. At 4:00 a.m. (adjustable) the exterior lights shall automatically turn on based on time schedule. Upon sunrise, which shall be based on longitude / latitude of the facility the exterior lights shall turn off.
 - 3. Between sunrise and sunset, photo-sensor shall only deactivate all exterior lighting when ambient light levels are above set point (adjustable).

POINT DESCRIPTION	TYPE	DEVICE
Lighting Contactor	DO	Control Relay
Momentary Control Switch	DI	Switch

- G. The new athletic storage building shall be controlled locally and shall not be part of the BMCS system.
- H. Auditorium Storage Temperature Sensor: Provide a temperature sensor in new

Auditorium Storage room. BMCS shall monitor.

POINT DESCRIPTION	TYPE	DEVICE
Storage Temperature	AI	Space Sensor

- I. Chair Storage Humidity Sensor: Provide a humidity sensor in new Uniform Storage room. BMCS shall monitor and alarm when humidity is above setpoint.

POINT DESCRIPTION	TYPE	DEVICE
Storage Temperature	AI	Space Sensor

3.14 TERMINAL UNIT COORDINATION

- A. Equipment furnished in this section and installed by Section 23 36 16:
 - 1. Automatic temperature control card (DDC).
 - 2. Damper Actuator
- B. Equipment furnished and installed by Section 23 36 16:
 - 1. Damper.
 - 2. Multi-point flow sensor.
 - 3. Power transformer.
 - 4. Controller enclosure.

3.15 VARIABLE VOLUME DUAL DUCT AIR HANDLING UNITS (AHU-G5)

- A. Units consist of a chilled water coil, a hot water coil, a fan, and a variable speed drive. Controls shall be as follows:
 - 1. An electronic averaging duct sensor in the cold duct shall, acting through the DDC System, modulate the chilled water valve to maintain desired setpoint. An electronic averaging duct sensor in the hot deck shall, acting through the DDC system, modulate the hot water valve to maintain desired setpoint. A schedule shall be set up for the hot deck temperature based on outside air temperature. The temperature of the hot deck shall modulate between the following criteria. If the temperature outside is 50°F (adjustable) or below, the hot deck temperature shall be 95°F; if the outside temperature is 75°F or above, the hot deck coil shall be deactivated.
 - 2. The unit shall be started and stopped from the BMCS system.
 - 3. An electronic duct static pressure sensor shall be located in the cold duct at a position approximately 2/3 the distance from the fan in the longest duct run. Location is to be approved by Engineer and coordinated with Section 23 05 93. The sensor shall transmit a signal to the supply fan motor speed controller, and modulate the fan speed to maintain a supply duct static pressure. A high limit static pressure sensor with manual reset, located at the fan discharge, shall de-energize the supply fan when sensing pressure above duct construction capabilities. Fan start-up shall be initiated at minimum air speed.
 - 4. Provide a duct static pressure reset sequence to reset duct static pressure setpoint based on terminal box damper position.
- B. Outside air for these units are being provided pretreated from a separate Outside Air Unit.

POINT DESCRIPTION	TYP	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Air Flow Sensing Switch
Discharge Air Temperature (2)	AI	Duct Temperature Sensor, One Each Deck
HW Coil Leaving Air Temperature	AI	Averaging Duct Thermistor
CHW Coil Leaving Air Temp.	AI	Averaging Duct Thermistor
HW Valve	AO	Electronic Operator
CHW Valve	AO	Electronic Operator
Duct Static Pressure (2)	AI	Static Pressure Sensor, One Each Deck
Fan Speed	AO	Variable Frequency Drive

3.16 OUTSIDE AIR HANDLING UNIT CONTROL (OAHU-G6)

- A. These units are furnished with a chilled water coil and a hot water heating coil in the PREHEAT position. Control shall be as follows:
1. A duct mounted sensor sensing supply air temperature shall, acting through the Direct Digital Control Panel, modulate the valve on the cooling coil and the valve on the hot water coil, in sequence, to maintain the desired discharge air temperature of 55°F. The air-handling unit shall be started and stopped from the BMCS System.
 2. Provide a temperature low limit switch located on the discharge side of the hot water preheat coil or the entering side of the cooling coil to de-energize the air handling unit, close the outside air damper, open the hot water valve 100%, start the boiler and hot water pump, signal an alarm to the BMCS when the temperature drops below 32°F. Device shall be manual reset.
 3. Open OA damper before starting unit. Provide end switch to ensure damper is in the open position in either the manual (hand) or auto position of the motor starter.
 4. The variable frequency drive shall be used for soft start and initial air balance.
- B. Project consists of OAHUs that serve either a single AHU or multiple AHUs, OAHUs shall be scheduled to operate through BMCS with software interlocks to the appropriate AHUs.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Air Flow Sensing Switch
CHW Coil Discharge Air Temp.	AI	RTD Average Probe
CHW Valve	AO	Electronic Operator

POINT DESCRIPTION	TYPES	DEVICE
Outside Air Damper	DO	Electronic Operator
Freeze Status	DI	Temperature Low Limit Switch
Variable Speed Motor	AO	Motor Controller
HW Pre Heat Valve	AO	Electronic Operator

3.17 DOUBLE DUCT VARIABLE VOLUME TERMINAL UNITS

- A. Each unit shall consist of two pressure independent variable volume dampers, one on each duct inlet connection. Controls shall be as follows:
1. A space temperature sensor shall, through the direct digital control system, modulate the variable volume damper on the cold deck from full open to 40% air flow rate to maintain room setpoint. When heating is required, the temperature sensor shall first modulate the variable volume damper on the hot duct and cold deck while maintaining 40% airflow. If more heating is required, the temperature sensor shall modulate the variable volume damper on the hot deck from 40% to full open to maintain room setpoint.
 2. The BMCS Contractor shall furnish the terminal box manufacturer with a controller to be factory mounted. The controller shall display cfm, temperature, and damper position.
 3. The BMCS Contractor shall furnish the terminal box manufacturer the control flow diagram for correct mounting of flow measurement devices, wiring of actuators, and terminal equipment controllers.

POINT DESCRIPTION	TYPE	DEVICE
Space Temperature	AI	Temperature
Primary Air (2)	AO	Variable Volume Damper Operator
CFM Flow	AI	Control Panel

3.18 NATATORIUM HEAT EXCHANGER SYSTEM

- A. System consists of tube and shell heat exchangers with hydronic hot water on one side and pool water on the other side. There are two heat exchangers that require different temperatures to be maintained, one for main swimming pool and one for the warmup pool. The main swimming pool and the warmup pool each have a dedicated pool water pumps and a shared hydronic hot water pump. Control of the hydronic hot water heating system is as follows:
1. Energize the natatorium heat exchanger system and hot water heating system whenever there is a call for pool water heating from either of the Pool temperature sensors.
 - a. Monitor pool water temperature for each the main swimming pool and warmup pool. Sensor shall be in pool water supply piping from pool filtration pump prior to taps for pool heating loops.
 - b. The boiler controller shall control all functions and sequencing of the hot water heating boiler.
 2. Upon a call for heating in the pool, the heat exchanger control valve on the hot

water side shall modulate based on the leaving water temperature from the heat exchanger on the pool water side of the heat exchanger. In addition, the pool water pump shall be energized and the mixing valve shall be modulated to meet the pool water temperature setpoint.

POINT DESCRIPTION	TYPES	DEVICE
Pool Water Pump Start/Stop (Warm Up)	DO	Variable Frequency Drive
Pool Water Pump Status (Warm Up)	DI	Current Sensitive Relay
Pool Water Pump Start/Stop (Main)	DO	Variable Frequency Drive
Pool Water Pump Status (Main)	DI	Current Sensitive Relay
Hot Water Pump Start/Stop (Hydronic)	DO	Variable Frequency Drive
Pool Water Pump Status (Hydronic)	DI	Current Sensitive Relay
Warm Up Pool Temperature	AI	Pipe Thermistor
Main Pool Temperature	AI	Pipe Thermistor
Hot Water Control Valve	AO	Electronic Operator (Each HX)
HX Pool Water Entering Temp.	AI	Pipe Thermistor (Each HX)
HX Pool Water Leaving Temp.	AI	Pipe Thermistor (Each HX)
Pool Water Control Valve	AO	Electronic Operator (Each HX)

3.19 START-UP AND POINT VERIFICATION

- A. Final startup and point verification shall include the following information.
 - 1. Field panel checkout:
 - a. Verify enclosure is not mounted on vibrating surface.
 - b. Verify class I and class II wiring is separated within enclosure.
 - c. Check for shorts/grounds/induced voltages/proper voltages.
 - d. Verify proper point terminations in accordance with as-builts.
 - e. Verify that all modules are in proper place and addressed.
 - f. Verify proper power voltage.
 - g. Load database and programming.
 - h. Startup the panel.
 - i. Point and device checkout.
 - 2. Analog input point checkout:
 - a. Verify the correct wiring terminations per the design documentation package, at the field panel. Verify that all wiring and terminations are neat and dressed.
 - b. Verify the point address by checking that the analog input instrument is wired to the correct piece of field equipment. Do this by altering the environment at the sensing element or by disconnecting one of the wires

- at the sensor, and verifying that the reading at the field panel has reacted to this change.
- c. Verify the point database to be correct, (i.e., alarmability, alarm limits, slope/intercept, engineering units, etc.). Verify that the correct change of value (COV) limit has been defined.
 - d. Verify the sensor has the correct range and input signal. (i.e., 20-120°F, 4 - 20 ma). Verify that the device is mounted in the correct location and is wired and installed correctly per the design documentation package.
 - e. Set-up and/or calibrate any associated equipment (i.e., panel LCD meters, loop isolators, etc.). Verify that these auxiliary devices are mounted in the correct location and are wired and installed correctly per the design documentation package.
 - f. Verify the correct reading at the field panel using appropriate MMI devices. Verify that any associated LCD panel meters indicate the correct measured value.
3. Digital input point checkout:
- a. Verify the device is correctly wired and terminated as shown in the design documentation package. Verify that all wiring and terminations are neat and properly secured.
 - b. Verify the point address by verifying that the digital input is correctly terminated at the controlled piece of equipment.
 - c. Verify the point database is correct (i.e., point name, address, alarmability, etc.).
 - d. Set-up and/or calibrate the associated equipment, i.e. smoke detector, high/low temp detector, high/low static switch, flow switch, end switch, current relay, pressure switch, etc. is mounted in the correct location, and is wired and installed correctly per the control system installation drawings.
 - e. With the controlled equipment running or energized as described in the digital output checkout procedures, verify the correct operation of the digital input point and associated equipment by putting the digital input monitored equipment into its two states. Verify that the proof or status point indicates the correct value at the operator's terminal and that the status led is giving the proper indication in each mode of operation (on/off).
4. Digital output point checkout:
- a. Verify that device is correctly wired and terminated as shown in the design documentation package.
 - b. Verify that the correct voltage is utilized in the circuit.
 - c. Verify the point database to be correct (i.e. point name, address, etc.).
 - d. Check and verify that the end device responds appropriately to the digital output(s).
 - e. After verifying the set-up and operation of any associated digital input/proof points, check and verify correct operation of the logical point and associated equipment by commanding the point to all possible states (i.e. off, on, fast, slow, auto, etc.). Verify that the defined proof delay is adequate for all modes of operation.
 - f. If any interlocked equipment exists that has independent hand-off-auto or auxiliary control wiring, verify correct operation of same. Also check that any interlocked equipment such as EP switches for damper operation or exhaust and return fans are wired correctly and operate correctly.

- g. Verify that the controlled piece or pieces of equipment cannot be caused to change state via the digital output if an associated hand-off-auto switch is in the hand/on or hand/off mode of operation, unless specified as a fireman's override point etc.
- 5. Analog output point checkout:
 - a. Verify the correct wiring or piping terminations per the design documentation package, at the field panel. Verify that all wiring and piping terminations are neat and dressed.
 - b. Insure that the correct output device(s) are installed per the Control System Installation Drawings. (i.e., I/P or P/I transducers, transformers, power supply, etc.). Verify that these devices are installed, wired and piped correctly. Verify that any configuration jumpers are in the proper settings for the required application. Verify related transformers are fused in accordance with installation drawings.
 - c. Verify the point database to be correct. Verify that the correct COV limit has been defined.
 - d. Verify the point address by checking that the analog output is wired and/or piped to the correct output transducer and/or equipment.
 - e. Verify that the controlled device is calibrated (i.e., 3-8PSI valve, 8-13 PSI damper motor, 4-20 ma variable frequency drive, etc.) and is in the correct location, and is wired or piped and installed correctly per the design documentation package. If the controlled device is not calibrated, then a three-point (high, low and mid-point) calibration procedure must take place. Verify proper operation of the end device. When calibration has been verified, ensure that installation drawings, point database, and PPCL have been updated.
 - f. Set-up and or calibrate any associated equipment, (i.e., panel LCD meters, loop isolators, pneumatic gauges, etc.). Also verify that these auxiliary devices are mounted in the correct location, and are wired or piped and installed correctly per the design documentation package.
 - g. After verifying the set-up and operation of any associated equipment check for the correct operation of the logical point and associated equipment by commanding the analog output to the top and bottom of its range. Verify that the control device(s) responded appropriately as indicated by the design documentation package. Check to insure that all network terminals, host console devices, etc. can also command these outputs.
 - h. Check that all pneumatic gauges, pilot positioners and LCD panel meters indicate the correct values.
- 6. Terminal equipment controller checkout:
 - a. Load program database
 - b. Enable programs
 - c. Verify sequence of operations
- 7. Programming checkout:
 - a. Provide checkout for each system and sequence of operation.
 - b. The following are sample sequence of operations tests. The intent of these procedures is to provide a plan of action to verify system operations via block checks of the project specific sequence of operations. The procedures may be used in this format, or one procedure to a page should more detail be required. The procedures outlined below should be verified for accuracy, and may be modified to

- meet your specific requirements.
 - c. Description of Test: AHU Alarm Checkout. Verify AHU-1 discharge air temperature alarming is operational and is received at the designated terminal.
 - d. Input to Trigger Test: Change discharge temperature high alarm limit through software to a value below the current discharge temperature (discharge temperature - 10°F).
 - e. Expected Outcome: A high temperature alarm will be received per the Alarm Definition Report at its designated terminal.
 - f. Provide signoff sheet with indication for test Pass, Fail, Date of test and Initials for signoff.
8. Workstation checkout:
- a. Verify the operation of all trunk interface equipment.
 - b. Verify all workstation software, including options, based upon the installation instructions for the PC.
 - c. Perform software backup (site, options, etc.)
 - d. Complete workstation configuration report for owner signoff.
 - e. Provide verification that all graphics have been created, as required by project bid documents.

3.20 TESTING AND ACCEPTANCE

- A. General:
- 1. After completion of installation and start-up procedures, commence the specified 3-phase verification and testing sequence leading to final acceptance.
 - a. Follow in the order specified.
 - b. Each testing phase shall be satisfactorily completed before entering the next phase.
 - 2. Prior to entering each phase of the sequence, submit for approval, a written agenda describing in detail the procedure to be followed to meet the requirements for each specified verification, test or demonstration.
 - 3. Submit for approval, a sample of the form on which the test will be reported.
 - a. Identify project.
 - b. Provide a list of all points, arrange in numerical order of point addresses.
 - 1) Show point descriptor and location of each.
 - 2) Indicate DDC panel that processes each point.
 - 3) Use the list as a basis for the specified report form.
 - c. Signatures of participants and observers.
 - d. Results.
 - e. Description of adjustment or corrections of points in error.
 - f. Date.
 - 4. Provide schedule of tests. Estimate dates of significant events.
 - 5. Test, calibrate and adjust each point in the system as specified.
 - 6. Provide documentation of all tests and verifications as specified.
 - 7. Provide trend reports indicating proper control of all points for an extended period of time.
- B. Phase 1 - Testing, Calibrating, and Adjusting:
- 1. Operate each analog point in the entire system.
 - a. At a point in the upper quarter of its range.
 - b. At a point in the lower quarter of its range.
 - c. At its operating point.
 - 2. Provide personnel and diagnostic instruments at both the central and remote locations.

3. Provide testing stimulants for alarms.
4. Use digital meters of double the accuracy of the instruments being calibrated.
5. Provide an approved test device for simulating high and low temperatures.
6. When the function is performed, read values at the central control and observe the actual function at the field instrument.
7. Exercise each binary point and observe indication at console and simultaneously observe operation in the field.
8. Submit an operation report for each point in the system, in approved format, and describe any corrective or adjusting action taken.
9. Test all power transducers with a Dranetz Power Analyzer.
- C. Phase 2 - Equipment and Point Verification:
 1. Verify calibration or function of each point.
 - a. Verify analog points at operating value.
 - b. Record on specified form.
 - c. Make approved adjustments to out of tolerance points.
 - 1) Identify these points for ready reference.
 2. After verification procedure in completed:
 - a. Verify corrected points.
 - b. Record on specified form.
 - c. Points requiring correction.
 - 1) Replace sensor or actuator if electrical measurements indicated components are out of specified tolerance.
- D. Phase 3 - Software Verification:
 1. Submit agenda and report format for software demonstrations.
 2. Demonstrate to the Owner and the Engineer that all software programs and automatic control sequences function as specified.
 3. Demonstrate compliance with response time specifications.
 - a. Simulate normal heavy load conditions.
 - b. Initiate at least ten successive occurrences on normal heavy load conditions as specified, and measure response time of typical alarms and status changes.
 4. Provide written documentation of demonstration, signed by representatives of the Contractor and Engineer.
- E. Provide the following reports to Engineer at final completion of all Testing:
 1. List of all points.
 2. List of all points currently in alarm.
 3. List of all disabled points.
 4. List of all points in over-ride status.
 5. List of all points currently locked out.
 6. List of user accounts and access levels.
 7. List all weekly schedules.
 8. List of holiday programming schedules.
 9. List of limits and deadbands.
 10. System diagnostics reports including, list of DDC panels on line and communicating, status of all DDC terminal units device points.
 11. List of programs.
 12. Provide trend data reports to ensure proper operation and sequence control of BMCS.
- F. Substantial Completion of the BMCS will not occur until completion and acceptance of all testing and acceptance procedures.

3.21 TRAINING

- A. The contractor shall provide factory-trained instructor to give full instruction to designated

personnel in the operation of the system installed. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. The contractor shall provide all students with a student binder containing product specific training modules for the system installed. All training shall be held during normal working hours of 8:00 am to 4:30 PM weekdays.

- B. Provide 40 hours of training for Owner's designated operating personnel. Training shall include:
 - Explanation of drawings, operations and maintenance manuals
 - Walk-through of the job to locate control components
 - Operator workstation and peripherals
 - DDC controller and ASC operation/function
 - Operator control functions including graphic generation and field panel programming
 - Operation of portable operator's terminal
 - Explanation of adjustment, calibration and replacement procedures
 - Student binder with training modules
- C. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Contractor.

3.22 PROJECT MANAGEMENT

- A. Provide a designated project manager who will be responsible for the following:
 - 1. Construct and maintain project schedule.
 - 2. Authorized to accept and execute orders or instructions from General Contractor, Owner / Architect & Engineer.
 - 3. Attend project meetings as necessary to avoid conflict and delays.
 - 4. Make necessary field decisions relating to this section.
 - 5. Coordination / Single point contact.
 - 6. Have Internet access for project management.

END OF SECTION

SECTION 23 0934
COORDINATION OF BUILDING MANAGEMENT AND CONTROL SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The Building Management and control System for the facility is being replaced. The items listed below shall be furnished and/or installed by this contractor.

PART 2 - PRODUCTS

- A. Products provided by the Building Management and Control System (BMCS) Contractor.
 - 1. Control Valves
 - 2. Dampers
 - 3. Wells for sensors installed in piping system
 - 4. Flow Meters

PART 3 - EXECUTION

3.1 COORDINATION

- A. Coordinate with the Building Management and Control System (BMCS) Contractor.
 - 1. Provide project-scheduling information to the BMCS Contractor to allow ample time for purchase of equipment and devices.
 - 2. Schedule periodic project meetings to review progress and coordination issues.
 - 3. Submit a written report, to the Architect/Engineer, on a monthly basis stating status of coordination effort.
- B. The BMCS contractor will submit shop drawings to this contractor for review and coordination processing.

3.2 INSTALLATION

- A. This Contractor will be responsible for the following:
 - 1. Installation of control valves for HVAC equipment.
 - 2. Installation of dampers for HVAC equipment.
 - 3. Installation of temperature sensor wells in piping.
 - 4. Installation of pressure taps in piping system.
 - 5. Installation of flow meter taps in piping system.
- B. Install the above material under the direction of the Building Management and Control System (BMCS) Contractor.

END OF SECTION

SECTION 23 2000
HVAC PIPE AND PIPE FITTINGS - GENERAL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install pipe and pipe fittings for piping systems specified in Division 23 - Mechanical.

1.2 RELATED WORK

- A. Division 23 Mechanical:
 - 1. Earthwork.
 - 2. Valves, Strainers and Vents.
 - 3. Vibration Isolation.
 - 4. Insulation.
 - 5. Other Piping Sections

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. The particular type of pipe and fittings for each system is specified in the individual sections.

2.2 JOINTS

- A. Make screwed joints using machine cut USASI taper pipe threads. Apply a suitable joint compound to the male threads only. Ream the pipe to full inside diameter after cutting. All-thread nipples are not permitted.
- B. Dissimilar Metals. Make joints between copper and steel pipe and equipment using insulating unions or couplings such as Crane Company #1259; EPCO as manufactured by EPCO Sales, Inc.; or an approved equal.
- C. Solder joints.
 - 1. Prior to making joints, cut pipe square and ream to full inside diameter. Clean exterior of pipe and socket. Apply a thin coat of suitable fluxing compound to both pipe and socket, and fit parts together immediately.
 - 2. Heat assembled joint only as required to cause the solder to flow. Run the joint full, slightly beaded on the outside, and wipe to remove excess solder.
 - 3. Use silver brazing alloy or Sil-Fos on refrigerant piping and on underground piping. Use lead free solder on all other copper piping.
- D. Make welded joints as recommended by the standards of the American Welding Society. Ensure complete penetration of deposited metal with base metal. Provide filler metal suitable for use with base metal. Keep inside of fittings free from globules of weld metal. The use of mitered joints is not approved.
- E. Flanged.
 - 1. Prior to installation of bolts, center and align flanged joints to prevent mechanical pre-stressing of flanges, pipe or equipment. Align bolt holes to straddle the vertical, horizontal or north-south centerline. Do not exceed 3/64" per foot inclination of the flange face from true alignment.
 - 2. Use flat-face companion flanges only with flat-faced fittings, valves or equipment. Otherwise, use raised-face flanges.
 - 3. Install gaskets suitable for the intended service and factory cut to proper dimensions. Secure with manufacturers recommended gasket cement.
 - 4. Use ANSI nuts and bolts, galvanized or black to match flange material. Use ANSI 316 stainless steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Draw bolts tight to ensure proper seating of gaskets.
 - 5. Use carbon steel flanges conforming to ANSI B16.5 with pipe materials

conforming to ASTM A 105 Grade II or ASTM A 108, Grade II, ASTM A 53, Grade B. Use slip-on type flanges on pipe only. Use welding neck type flanges on all fittings. Weld slip-on flanges inside and outside.

6. Keep flange covers on equipment while fabricating piping. Remove when ready to install in system.
- F. Mechanical Joints: Provide a stuffing box type mechanical joint adapted to use gasket, cast iron gland and bolts. Coat bolts with bitumastic enamel. Use joint parts similar in design to one of the following:
1. Doublex Simplex Joint manufactured by the American Cast Iron Pipe Company, Birmingham, Alabama.
 2. U.S. joints manufactured by the United States Pipe and Foundry Company, Burlington, New Jersey.
 3. Boltite Joint manufactured by the McWane Cast Iron Pipe Company, Birmingham, Alabama.
 4. Flexlamp manufactured by the National Cast Iron Pipe Company, Birmingham, Alabama.

2.3 UNIONS

- A. Use 150 lb. standard (300 lb. WOG) malleable iron, ground joint unions with bronze seat. Provide flanged joints on piping 2-1/2" and larger.
1. Where pipe material of different types join, use a dielectric union. Union shall be threaded, solder or as required for its intended use.

2.4 BRANCH CONNECTIONS

- A. Pipe 2" and Smaller: For threaded piping, use straight size reducing tee. When branch is smaller than header, a nipple and reducing coupling or swagged nipple may be used.
- B. 2-1/2" through 36": For welding piping, when branch size is the same as header size, use welding tee. For threaded branch connections, use 3000 lb. full coupling or Thread-o-let welded to header.

2.5 GASKETS

- A. High Temperature Piping: Provide 1/16" thick ring gaskets of aramid reinforced SBR such as Garlock #3200 or 3400 or equal by Advanced Products and Systems.
- B. Other Piping: Provide ring rubber gaskets, Garlock #7992 or equal by Advanced Products and Systems. Use 1/8" thick cloth reinforced neoprene gaskets. For smaller than 6", use 1/16" thick gasket.

2.6 FLOORS AND CEILING PLATES

- A. Provide chrome-plated floor and ceiling plates around pipes exposed to view when passing through walls, floors, partitions, or ceilings in finished areas; size plates to fit pipe or insulation and lock in place.

2.7 DOMESTIC MANUFACTURE

- A. All piping material, pipe and pipe fittings shall be manufactured in the United States of America.

PART 3 - EXECUTION

3.1 PIPE FABRICATION AND INSTALLATION

- A. Make piping layout and installation in the most advantageous manner possible with respect to headroom, valve access, opening and equipment clearance, and clearance for other work. Give particular attention to piping in the vicinity of equipment. Preserve the required minimum access clearances to various equipment parts, as recommended by the equipment manufacturer, for maintenance.

- B. Cut all pipes to measurement determined at the site. After cutting pipe, remove burrs by reaming. Bevel plain ends of ferrous pipe.
- C. Install piping neatly, free from unnecessary traps and pockets. Work into place without springing or forcing. Use fittings to make changes in direction. Field bending and mitering is prohibited. Make connections to equipment using flanged joints, unions or couplings. Make reducing connections with reducing fittings only.
- D. Install piping without tapping out of the bottom of pipe.

3.2 WELD

- A. Weld and fabricate piping in accordance with ANSI Standard B31.1, latest edition, Code for Pressure Piping.
- B. Align piping and equipment so that no part is offset more than 1/16". Set fittings and joints square and true, and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.
- C. Do not permit any weld to project within the pipe so as to restrict flows. Tack welds, if used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welds during welding operation.
- D. Do not split, bend, flatten or otherwise damage piping before, during or after installation.
- E. Remove dirt, scale and other foreign matter from inside piping before tying into existing piping sections, fittings, valves or equipment.
- F. Bevel ends of ferrous pipe.

3.3 OFFSETS AND FITTINGS

- A. Due to the small scale of drawings, the indication of offsets and fittings is not possible. Investigate the structural and finish conditions affecting the work and take steps required to meet these conditions.
- B. Install pipe close to walls, ceilings and columns so pipe will occupy minimum space. Provide proper spacing for insulation coverings, removal of pipe, special clearances, and offsets and fittings.

3.4 SECURING AND SUPPORTING

- A. Support piping to maintain line and grade, with provision for expansion and contraction. Use approved clevis-type or trapeze-type hangers connected to structural members of the building. Single pipe runs to be supported by approved clevis type hangers. Multiple pipe runs to be supported by approved trapeze type hangers. Do not support piping from other piping or structural joist bridging. Review structural drawings for additional information.
- B. Provide supports both sides and within 12" of each horizontal elbow for pipe 6" and larger.
- C. Support vertical risers with steel strap pipe clamps of approved design and size, supported at each floor. Support piping assemblies in chases so they are rigid and self-supported before the chase is closed. Provide structural support for piping penetrating chase walls to fixtures. On chilled water pipe supports shall be outside the insulation.
- D. Where insulation occurs, design hangers to protect insulation from damage. Pipe saddles and insulation shields, where required, are specified in the appropriate insulation section and are sized in accordance with the schedule on the drawings.
- E. Install trapeze hangers, properly sized, to support the intended load without distortion. Use hangers with 1-1/2" minimum vertical adjustment.
- F. Use electro-galvanized or zinc plated beam clamps if acceptable to the structural engineer, threaded rods, nuts, washers and hangers. All hanger rods shall be trimmed neatly so that no more than 1 inch of excess hanger rod protrudes beyond the hanger nut. Use only on beams as directed by the Structural Engineer.
- G. At outdoor locations, all supports, brackets and structural members shall be hot-dipped

- galvanized.
- H. Provide hangers within 3' of pipe length from all coil connections.
- I. Support spacing: As recommended by the project structural engineer and support manufacturer, but not more than listed below. Not to exceed spacing requirements of smallest pipe.

Pipe Size	Copper & Steel Max. Support Spacing, Ft.	Cast Iron Max. Support Spacing, Ft.	Minimum Rod Diameter, Inches
1" & smaller	6		3/8
1-1/4" & 1-1/2"	8	5	3/8
2"	10	5	3/8
3"	10	5	1/2
4" & 5"	10	5	5/8
6" and above	10	5	3/4

3.5 PIPE SUPPORTS

- A. Provide P1001 or P 5000 Unistrut metal framing members and appurtenances for pipe support. Hot-dip galvanized members and appurtenances when located outside. Sagging of pipes or supports is not acceptable.
- B. Adjustable clevis hangers shall be used for single pipe supports; Anvil Fig. 260. When oversized clevis is used, a nipple shall be placed over the clevis bolt as a spacer to assure that the lower U-strap will not move in on the bolt. Provide adjustable clevis with a nut / washer above and below the hanger on the support rod. Ring type clevis hangers are not acceptable.
- C. Provide Anvil Figure 45 galvanized or primed and painted channel assembly for trapeze hangers.

3.6 PIPE SUPPORTS ON ROOF

- A. Support condensate drain pipe on roof with Portable Pipe Hanger Model PP-10 with roller and fully adjustable height throughout pipe run. Base material shall be high density / high impact polypropylene with UV inhibitors and anti-oxidants. Provide with hot dip galvanized rod finish and framing. Nuts and washers shall be hot dip galvanized.

3.7 PIPE STANDS

- A. Refer to Pipe Stand detail included in drawings for additional information.
- B. All ground mounted pipe stands shall be steel construction and hot dipped galvanized after fabrication.
- C. All pipe stand bases shall be anchored, leveled and grouted to ensure equal weight distribution.

3.8 ANCHORS

- A. Provide anchors as required. Use pipe anchors consisting of heavy steel collars with lugs and bolts for clamping to pipe and attaching anchor braces. Install anchor braces in the most effective manner to secure desired results. Do not install supports, anchors or similar devices where they will damage construction during installation or because of the weight or the expansion of the pipe. When possible, install sleeves in structural concrete prior to pouring of concrete.

3.9 FLOOR PENETRATIONS

- A. At locations where pipe passes through floors, provide watertight concrete curb around penetration.

3.10 PIPE SLEEVES

- A. Sleeves through masonry and concrete construction:
 - 1. Fabricate sleeves of Schedule 40 galvanized steel pipe.
 - 2. Size sleeve large enough to allow for movement due to expansion and to provide continuous insulation.
- B. Sleeves through gypsum wall construction.
 - 1. Fabricate sleeves of 16 gauge galvanized sheet metal.
- C. Sleeves through elevated slab construction.
 - 1. Fabricate sleeves of Schedule 40 galvanized steel pipe with welded center flange in floor.
- D. Extend each sleeve through the floor or wall. Cut the sleeve flush with each wall surface. Sleeves through floors shall extend 2" above floor lines for waterproofing purposes. Slab on grade floors shall not be sleeved except where penetrating waterproofing membrane or insect control is required.
- E. Caulk sleeves water and air tight. Seal annular space between pipes and sleeves with mastic compound to make the space water and air tight.
- F. For sleeves below grades in outside walls, provide Thunderline Link-Seal or Advance Product and System Interlynx, with 316 stainless steel nuts and bolts, with cast iron pressure plate.
- G. Provide chrome plated escutcheon plates on pipes passing through walls, floors or ceilings exposed to view. At exterior walls, stainless steel sheet metal is to be used.
- H. For sleeves through fire and smoke rated walls, seal with a UL through-penetration firestop, rated to maintain the integrity of the time rated construction. Install in accordance with the manufacturer's installation instructions. Comply with UL and NFPA standards for the installation of firestops. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

3.11 ISOLATION VALVES

- A. Provide piping systems with line size shutoff valves located at the risers, at main branch connections to mains for equipment, to isolate central plant, and at other locations.

3.12 DRAIN VALVES

- A. Install drain valves at low points of water piping systems so that these systems can be entirely drained. Install a line size drain valve for pipes smaller than 2" unless indicated otherwise. For pipes 2-1/2" and larger, provide 2" drain valves unless indicated otherwise. Drain valves shall be plugged when not in use and at completion.

3.13 CLEANING OF PIPING SYSTEMS

- A. General cleaning of piping systems. Purge pipe of construction debris and contamination before placing the systems in service. Provide and install temporary connections as required to clean, purge and circulate. Flush the chilled and hot water systems utilizing the filter feeders.
- B. Install temporary strainers at the inlet of pumps and other equipment as necessary where permanent strainers are not indicated. Keep strainers in service until the equipment has been tested, then remove either entire strainer or straining element only. Fit strainers with a line size blow down ball valve and pipe to nearest drain. Blow down strainers, remove and clean as frequently as necessary.
- C. Phase One: Initial flushing of system. Remove loose dirt, mill scale, weld beads, rust and other deleterious substances without damage to system components. Open valves, drains, vents and strainers at all system levels during flushing procedures. Flush until "potable water clear" and particles larger than 5 microns are removed.
- D. Connect dead-end supply and return headers, even if not shown on the drawings, and

- provide terminal drains in bottom of pipe end caps or blind flanges.
- E. Dispose of water in approved manner.
- F. Phase Two: Cleaning of Piping Systems. Remove, without chemical or mechanical damage to any system component, adherent dirt (organic soil), oil, grease, (hydrocarbons), welding and soldering flux, mill varnish, piping compounds, rust (iron oxide) and other deleterious substances not removed by initial flushing. Chemical shall be equal to Nalco 2578 prepping compound. Insert anti-foam compound as necessary. Circulate for 48 hours or as recommended by the manufacture. Dispose of water in approved manner. Flush system and replace with clean water. Verify compatibility of chemicals used with existing chemical treatment program on remodel projects.
- G. Phase Three: Final flushing and rinsing: Flush and rinse until “potable water clear” and particles larger than 5 microns are removed. Operate valves to dislodge any debris in valve body. Dispose of water in approved manner.
- H. Submit status reports upon completion of each phase of work on each system.
- I. Special requirements, if any, are specified in the sections on each type of piping or in the section on Water Treatment Systems.

3.14 TESTING

- A. Test piping after installation with water hydrostatic pressure of 1-1/2 times operating pressure (150 psig minimum) and carefully check for leaks. Repair leaks and retest system until proven watertight.
- B. Do not insulate or conceal piping systems until tests are satisfactorily complete.
- C. If any leaks or other defects are observed, suspend the test and correct the condition at once. Repeat testing until leaks are eliminated and the full test period is achieved.
- D. The satisfactory completion of testing does not relieve the Contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories.

3.15 PIPE MARKERS

- A. Identify interior exposed piping and piping in accessible chases or plenums with Opti-Code Brady Pressure Sensitive Adhesive Pipe Markers, consisting of pipe marker and direction of flow arrow tape. Clean pipe prior to installation. Background colors of markers, arrows and tape for each type of system shall be the same. Meet ANSI/OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.
- B. Identify exterior and mechanical room piping with Snap Around pipe markers through 4-inch pipe and Strap Around markers 5-inch pipe and larger. Pipe markers consisting of pipe marker and direction of flow arrow tape; background colors of markers, arrows and type for each type of system shall be the same. Meet ANSI / OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.
- C. Install identification in the following locations:
 - 1. both sides of penetrations through walls, floors and ceilings.
 - 2. Close to valves or flanges.
 - 3. Intervals on straight pipe runs not to exceed 50 feet
 - 4. Apply marker where view is obstructed.
- D. Pipe markers shall meet or exceed the specifications of the ASME A13.1 “Scheme for Identification of Piping Systems”.

END OF SECTION

SECTION 23 2113
HOT WATER AND CHILLED WATER PIPING, VALVES AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install heating water and chilled water piping, valves and appurtenances, including fittings and strainers. Domestic hot water piping is specified in the Domestic Water Piping and Appurtenances section.

1.2 RELATED WORK

- A. Division 23 Mechanical:
 - 1. Pipe and Pipe Fittings - General
 - 2. Valves, Strainers and Vents
 - 3. Vibration Isolation
 - 4. Insulation

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. For pipe 2" and less in diameter, provide pipe conforming to ASTM A 53, Grade A or B, or ASTM A106 schedule 80 seamless, or electric-resistance welded black steel pipe. Furnish 150 lb. screwed malleable iron fittings conforming to ANSI B 16.3 for chilled water. Provide fittings conforming to ANSI B 16.4 for hot water.
- B. For pipe 2-1/2" in diameter and larger, provide pipe meeting the requirements of ASTM A 53, Grade A or B, or ASTM A 106 schedule 80 seamless, or electric-resistance welded black steel pipe with standard weight seamless steel welded fittings, satisfying ASTM A 234, Grade WPA or WPB, ANSI B16.9.

2.2 VALVES

- A. Refer to Section 23 05 23.
- B. Refer to Building Management and Control System.

2.3 WATER SPECIALTIES

- A. Pressurized Expansion Tanks shall be precharged steel tank with a replaceable heavy duty Butyl rubber bladder. The tank shall have a 1-1/2" system connection, drain, and a standard tire valve to facilitate on-site charging of the tank. The tank shall be fitted with lifting rings and a floor mounting skirt for vertical installation. The tank must be constructed in accordance with Section VIII of ASME Boiler and Pressure Vessel Code and stamped 125 PSI working pressure.
 - 1. Acceptable manufacturers: Bell & Gossett, Taco, Wessels, John Wood Company, and Wheatley.
- B. Pressure Reducing Valves shall be diaphragm operated with brass body, low inlet pressure check valve and inlet strainer. The strainer shall be easily removed without system shutdown. The valve seat, strainer, and stem must be removable and of non-corrosive material.
 - 1. Acceptable Manufacturers: Bell & Gossett, Armstrong, Taco, and Wheatley.
- C. Automatic Air vents shall be float actuated high capacity air vent designed to purge free air from the system and provide shutoff at pressures up to 150 psig at a maximum temperature of 250 degrees F. The design of the high capacity air vent shall prevent air from entering the system if system pressure should drop below atmospheric pressure. The high capacity air vent shall purge free air at pressures up to 150 psig during normal system operation. The high capacity air vent shall be constructed of cast iron and fitted with components of stainless steel, brass, and EPDM.
 - 1. Acceptable Manufacturers: Bell & Gossett, Armstrong, Taco, and Wheatley.
- D. Air and Dirt Separators shall be a full flow coalescing type combination air eliminator and dirt separator. The separator shall be designed for full flow high volume systems. The

inlet and outlet connections shall be the same as adjoining pipe. Vessel shall be fabricated steel, rated for 150 psig working pressure, stamped and registered in accordance with ASME Section VIII, Division 1 for unfired pressure vessels, and include two equal chambers above and below the inlet and outlet nozzles. The vessel shall include copper or stainless steel coalescing medium to aid in the separation of air and dirt in the system entrained water. Air elimination efficiency shall be 100% free air, 100% entrained air, and a minimum of 99.6% dissolved air at the installed location. Dirt separation efficiency shall be a minimum of 80% of all particles 30 micron and larger within 100 passes. Unit shall be provided with a separate venting chamber to prevent system contaminants from harming the float and venting valve operation.

1. Acceptable manufacturer shall be Spirovent Series HV by Spirotherm, TACO High Velocity 4900, Thrush High Velocity.

PART 3 - EXECUTION

3.1 TESTING

- A. Test all piping systems to assure they are absolutely leak free.
- B. Apply a hydraulic pressure 1-1/2 times the operating pressure, 150 psig minimum, and check for leaks. Maintain test for a minimum of 24 hours. The piping system must remain absolutely tight during this period. The satisfactory completion of any test or series of tests will not relieve the contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories. The test should be observed by the Architect / Engineer before pressure is removed and water drained.

3.2 AIR HANDLING UNIT PIPING

- A. Provide a minimum of 12" of straight pipe at all coil piping connections.

3.3 AIR SEPARATOR

- A. Install full size drain to nearest floor drain.
- B. Install air vent drain to nearest floor drain.

END OF SECTION

**SECTION 23 2123
HVAC PUMPS**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. General characteristics for pumps specified in Division 23 - Mechanical.

1.2 RELATED WORK

Requirements for pumps are specified in other sections of Division 23 - Mechanical, including the following:

- A. Division 23 Mechanical - Electrical Provisions of Mechanical Work.
- B. Section 23 05 48 HVAC Vibration Isolation
- C. Section 23 05 50 Noise Control for Mechanical Systems

1.3 PUMP SELECTION

- A. Select pumps conservatively for scheduled conditions. Furnish pumps that have reasonably high efficiencies, with peak efficiency at or near rated conditions. Select pumps that will operate stably at 15' suction lift despite substantial reduction in head or substantial increase in delivery.
- B. If the pumps proposed are not considered suitable, submit manufacturer's data on other pumps, for review.
- C. Scheduled design flow, design head, pump efficiency, and motor horsepower are the minimum acceptable.
- D. The pump curve shall rise continuously from maximum flow to cut-off.
- E. Shut-off head approximately 10 percent greater than design head, unless otherwise indicated in pump schedules.
- F. Pump brake horsepower shall not exceed the motor horsepower rating over the entire operating range from shut-off to run-out.
- G. Select the pump for operation at or near peak efficiency.
- H. Cavitation-free at all points on the curve.
- I. Impeller diameter shall not exceed 90 percent of the maximum published diameter.
- J. Pumps shall be suitable for parallel operation. Where pumps are operated in parallel, individual pumps shall be capable of stable operation with only one pump operating in the system. Submit pump curves with single and multiple pumps operating on system curve for approval.

1.4 PUMP SIZE AND TYPE

- A. Provide motor-driven pumps of the type and speed scheduled. Select pumps that are not overloaded throughout the entire range of pump operation. Provide pump connection sizes as indicated.
- B. The head capacities indicated in the schedules are listed for bidding purposes only. Calculate the operating head at each pump; take into consideration the actual routing of the various lines, pressure drops in heat exchangers and coils, exact lengths of pipe, fittings, etc. Submit these calculations, together with copies of manufacturer's performance curves, as shop drawings on each pump. Clearly mark the curves for each pump to indicate the diameter of the impeller and the selection point.

1.5 CERTIFIED DATA

- A. Submit factory certified pump curves showing pump performance characteristics with pump and system operating points plotted. Curves shall include as a minimum, flow (gallons per minute), head (feet of water), all available impeller diameters (inches), efficiency (percent), net positive suction head required (feet of water), brake horsepower, pump size and pump model. When multiple pumps are operating in parallel, show pump

curves for one pump running, two pumps running, and so on. Show pump curves with system curve plotted.

1.6 DELIVERY OPTIONS

- A. Manufacturer shall provide quick shipment options to minimize product lead times.

PART 2 - PRODUCTS

2.1 VERTICAL IN-LINE (VIL) PUMPS

- A. Pump Construction:
1. Pump casing, cast iron with 125 psig ANSI/PN16 flanges for working pressure below 175 psig at 150°F and ductile iron with 250 psig ANSI / PN25 flanges for working pressure to 375 psig at 150°F.
 2. Suction and discharge connections shall be flanged and the same size and shall be drilled and tapped for seal flush and gauge connections.
 3. Impeller: Bronze, fully enclosed type; dynamically balanced, two-plan balancing is required where installed impeller diameter is less than 6 times the impeller width.
 4. Shaft: Provide 316 stainless steel pump shaft.
 5. Coupling: Rigid spacer type of high tensile aluminum alloy. Coupling is to be designed to be easily removed on site to reveal a space between the pump and motor shafts sufficient to remove all mechanical seal components for servicing and to be replaced without disturbing the pump or motor.
 6. Mechanical seals shall be stainless steel multi-spring inside or outside balanced type with Viton secondary seal, carbon rotating face and silicon carbide stationary seat. Provide 316 stainless steel glad plate. Provide factory installed flush line with manual vent.
 7. Split coupled pumps shall be provided with a lower seal chamber throttle bushing to ensure seals maintain positive cooling and lubrication.
 8. Provide seal flush supply line to the mechanical seal with a 50 micron cartridge filter and sight flow indicator to suit the working pressure encountered. Filters shall be changed by the installing contractor after system is flushed and on a regular basis until turned over to the Owner.
 9. Supply in the flush line to the mechanical seal a maintenance free sediment separator with sight flow indicator.
 10. Natatorium pumps shall utilize a cast 316 stainless steel impeller and a ductile iron casing with fusion bonded epoxy coating to withstand corrosion caused by chlorinated water.
- B. Single stage, single or double suction type, with pump characteristics which provide rising heads to shut off. Refer to pump schedule for pump flows and heads and motor speed, enclosure, efficiency and power requirements and other system conditions.
- C. Pump Motor:
1. Premium efficiency
 2. Totally enclosed fan cooled
 3. Cast iron frame and end plate
 4. (2) Forge steel lifting eye
 5. Over-sized conduit box with ground lug
 6. So sized with relation to the pump impeller that the brake horsepower requirements will not overload the motor at any point on the pump curve.
 7. Critical speed of the pump shall be at minimum 115% of the operating speed listed in the pump schedule.
 8. Designed for Variable Frequency Drive Application
 9. Greaseable bearings rated for a minimum of 200,000 hours.
 10. Minimum Efficiency

3 hp	1800 rpm	89.5%
5 hp	1800 rpm	90.2%
7.5 hp	1800 rpm	91.7%
10 hp	1800 rpm	91.7%
15 hp	1800 rpm	92.4%
20 hp	1800 rpm	93%
25 hp	1800 rpm	93.6%
30 hp	1800 rpm	94.1%
40 hp	1800 rpm	94.5%
50 hp	1800 rpm	94.5%
60 hp	1800 rpm	95%
75 hp+	1800 rpm	95.4%

- D. Data plates:
1. Provide the pump with a nameplate constructed of 300 series stainless steel securely fastened to pump casing with stainless steel pins.
 2. Locate the nameplate for easy visibility.
 3. Clearly stamp the rating conditions and other data below, as a minimum, on the nameplate.
 - a. Manufacturer, address, telephone number
 - b. Pump model number
 - c. Pump serial number
 - d. Size (including impeller diameter scheduled in inches)
 - e. Type
 - f. Equipment designation as listed on the pump schedule.
 - g. Flow scheduled (gallons per minute)
 - h. Dynamic head scheduled (feet of water)
 - i. Efficiency (percent)
 - j. Shut-off head (feet of water)
 - k. Speed (rpm)
 - l. Brake horsepower
 - m. Maximum brake horsepower with rated impeller
 - n. Rotation
 - o. Maximum allowable pressure (psig)
- E. The schedule on the drawing sets forth the type of pump and GPM required.
1. The head capacities and horsepower are for bidding purposes only.
 2. Make pump selection based on actual system calculations.
- F. Acceptable manufacturers:
1. Bell & Gossett
 2. Armstrong Series 4300
 3. Aurora
 4. Taco
 5. Grundfos
 6. Patterson

2.4 FLOW INDICATOR

- A. Flow Indicator:
1. Bronze Construction
 2. Rotating wheel
 3. Line Size
 4. Double Window
 5. Ernst Flow Industries Model EFI E-57-3

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install the pumps in accordance with Manufacturer's "Installation, Start-up and Service Instructions".
 - 1. Provide a minimum of 24" access space around pumps for service.
 - 2. Install pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place. Install stainless steel drain pan with trough under chilled water pumps only.
 - 3. Provide air cock and drain connection piped to floor drain.
 - 4. Lubricate pumps prior to start-up.
 - 5. Install condenser water pumps to ensure a full flooded suction.
 - 6. Paint entire unit with two coats of machinery enamel after completion of installation.
 - 7. Provide a spool piece between the suction diffuser and the suction side of the pump minimum length 8" face to face.
 - 8. Provide pressure taps with valves on each side of the pump.
 - 9. Install hot water circulator horizontally, properly supported to wall, in an accessible location for testing and maintenance at a height not to exceed 60" above finished floor. Install line size Ernst bronze rotating wheel, flow indicator with double window, downstream of circulator.
 - 10. Reference section 23 05 13 Article 3.1 paragraph D for motor wiring connectors.
- B. Provide a line size isolation valve and strainer on the pump suction and a line size silent check valve and balancing valve on the pump discharge. Provide an automatic air vent off the pump casing. For base mounted pumps, provide a drain line the full size of the base connection and extend it to and terminate it over the nearest floor drain.
- C. Support piping adjacent to the pump such that no weight is carried on the pump casing. Decrease from pipe size with eccentric reducer on suction side and concentric increaser on discharge side.
- D. Ensure pumps:
 - 1. Operate at specified system fluid temperatures without vapor binding and cavitation.
 - 2. Are non-overloading in parallel and individual operation.
 - 3. Operate within 25 percent of midpoint of published maximum efficiency curve.
- E. Refer to pump detail on the Contract Drawings for piping accessories to be provided.

3.2 MANUFACTURER START-UP SERVICE ALIGNMENT

- A. After installation, the pumps and motors are to be aligned by the manufacturer or their representative utilizing a dial indicator. After completion, a formal report must be submitted by the Manufacturer to the Engineer prior to final acceptance. This report must include pump serial number, location, beginning and final alignment at a minimum.
 - 1. Technicians, as required, shall be trained and experienced in the work they perform (contractor start-up / alignment is unacceptable).
- B. Before starting pumps, but after connecting piping:
 - 1. Align shafts and coupling with a precision dial indicator alignment instrument to the minimum tolerances .004 (TIR) per inch of coupling radius or as recommended by the manufacturer, whichever is the greater.
 - 2. Tabulate the actual pump alignment reading with manufacturer's minimum tolerances.
 - 3. Submit readings for approval.
 - 4. Include the approved readings in the Owner's Maintenance Manual.

3.3 FINAL PUMP FLOW CALIBRATION

- A. Based on the results of the final phases of the test and balance sequences, if the flow of

the unthrottled pump is more than 10% above the scheduled values:

1. Request detailed instructions from the pump manufacturer for the correct impeller diameter.
 2. Trim the impeller to the diameter recommended by the manufacturer, employing precision machinery.
- B. Enter the information on the final configuration of the pump in the Owner's Manual.
1. Modify the pump nameplate to reflect the correct head and flow data and the impeller diameter.

3.4 SPARE PARTS

- A. Provide the following spare parts and material to the Owner for his use after the warranty period.
1. An extra packing box rebuild kit and 5 packing rings for each condenser water pump.
 2. An extra mechanical seal for each vertical inline pump.
 3. A set of bearings for each horizontal pump.

END OF SECTION

SECTION 23 2300
REFRIGERANT PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install copper tubing, valves, strainers and sight glass for refrigerant piping.

1.2 RELATED WORK

- A. Division 23 Mechanical.
 - 1. Pipe and Pipe Fittings
 - 2. Piping Insulation

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. Furnish refrigerant piping of Type K hard-drawn copper tubing with sweat-type, wrought copper fittings. Cast fittings are not permitted.

2.2 SERVICE VALVES

- A. Provide angle or globe service valves, with sweat connections. Use packed-type, wrench operated, valves with gasketed seal cap and back seat feature. Furnish valves designed for refrigerant service, in conformance with the ARI code.
- B. Place service valves at the inlet and outlet of each compressor, on both sides of each strainer and solenoid valve, and as otherwise shown and specified.

2.3 SOLENOID VALVES

- A. Furnish pilot-operated, floating-piston solenoid valves suitable for operation with refrigerant.
- B. Use valves with a bronze body and sweat-type connections.
- C. Provide stainless steel stem and plunger assembly and a stainless steel piston.
- D. Furnish sealed and moisture proof solenoid coils.
- E. Use electrical characteristics of 115 volt, 60 Hertz.

2.4 SIGHT GLASSES

- A. Provide suitable moisture and liquid sight glass in the liquid line leaving the condenser or receiver.

2.5 FILTER DRYER

- A. Furnish replaceable core liquid line filter dryer.
- B. Provide filter dryer constructed to permit the removal of the core element without removing the filter dryer from the line.

PART 3 - EXECUTION

3.1 BRAZING

- A. During the brazing process, dry nitrogen shall be purged through the tubing to prevent oxides from forming.

3.2 PRESSURE TEST

- A. After refrigeration and piping system items are installed, charge the system with dry nitrogen and test to 450 psig.
 - 1. Test joints with a Halide torch or an electronic leak detector.
 - 2. Repair leaks and retest each system until proved tight.

3.3 EVACUATION AND DRYING

- A. After refrigerant system has been pressure-tested, connect a suitable vacuum pump and evacuate piping system, including lines and equipment.
 - 1. Maintain a vacuum as high as practicable for long enough to evaporate the moisture in the system (at least 48 hours).
 - 2. Check the humidity within the system with a wet bulb indicator, and maintain the vacuum until the wet bulb temperature is reduced to -40°F. After the system has been evacuated and dried, break the vacuum by charging proper refrigerant into the system.

3.4 PIPE SIZE

- A. Pipe shall be routed and sized per condensing unit manufacturer's instructions.

END OF SECTION

SECTION 23 2513
CIRCULATING WATER SYSTEM CHEMICAL TREATMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide equipment, chemicals and treatment materials for the complete water treatment system.
- B. Determine which chemicals to use from the results of a water sample analysis taken from the building domestic water supply.
- C. Provide water treatment products, holding reservoirs, equipment and labor for testing, cleaning, flushing and dispensing products to achieve the required water quality for each system specified.
 - 1. Closed chilled and hot water systems
 - 2. The cooling tower condenser water system
- D. Entire existing chilled water system shall be fully cleaned and flushed prior to the operation of chillers.
- E. Test all existing closed and open water systems and provide report to Owner and Engineer.

1.2 SERVICE AND SUPPLIES

- A. All work shall be performed by a qualified, full-time, Water Program Manager.
 - 1. Specialist in the field of industrial water treatment.
 - 2. Facilities include water analysis laboratory, development facilities and service department.
- B. Provide a water treatment test set for each system (pH, alkalinity, hardness, chloride) for field use including test equipment and reagents as required for specific use with the treatment products employed.
- C. Where specialized supplementary testing or control equipment is required, provide appropriate items.
- D. Provide a water management and service program for a period of one year beginning at substantial completion. Make routine visits bi-weekly during first two months of operation and monthly during the remainder of the specified period.
- E. Routing Services
 - 1. Check and adjust water treatment system operation.
 - 2. Instruct, train and advise operating personnel.
 - 3. Check efficiency of chemicals and chemical applications.
 - 4. Replenish chemicals and replace expendables.
 - 5. Clean or replace filter in feeder.
- F. Chemically clean the piping system.
- G. Provide a complete laboratory analysis of water samples. Insert in the Owner's manuals.
- H. Provide review of report figures in the field water testing.

1.3 QUALITY ASSURANCE

- A. Acceptable program manager shall have:
 - 1. Research and development facilities.
 - 2. Regional laboratories capable of making water analysis.
 - 3. A service department and qualified technical service representatives located within a reasonable distance of the project site.
 - 4. Service representatives who are registered Engineers or factory-certified technicians with not less than 5 years of water treatment experience with the water treatment system manufacturer.
- B. Ensure that all products, packaging, blow-down or other effluents do not violate local,

state, or federal laws or regulations. Use only chemicals that are registered, when required, with the U.S. Department of Agriculture or the U.S. Environmental Protection Agency and that are labeled as required by law.

- C. Provide electrical products that have been tested, listed and labeled by Underwriters Laboratories and comply with the National Electrical Manufacturers Association Standards.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Nalco Water – Ecolab (Danny Short 832-823-9716)

2.2 CLOSED CHILLED AND HOT WATER SYSTEM

- A. Side stream stainless steel filter feeders in the hot water and chilled water systems:
 - 1. Rated at 40-gpm capacity.
 - 2. Operating conditions: 200 psig and 250°F.
 - 3. Single filter cartridge.
 - 4. Cartridge #:
 - a. NALCO 231-FMPIC405HT
 - b. WATTS #FMPIC405HT
 - 5. Fabricated hot dipped galvanized steel support legs and frame. Refer to detail drawing for requirements.
 - 6. Provide sufficient quantity of filter cartridges for warranty period. Minimum of two additional cartridges provided to owner.
 - 7. Provide (2) two drains for filter housing. (1) clean water drain, (1) dirty water drain.
- B. Acceptable Manufacturers: Side Stream Cartridge Filter Housing
 - 1. NALCO #231-FMJCH40
 - 2. WATTS #FMJCH40
- C. Treatment chemicals:
 - 1. Furnished as a concentrated liquid in 5 gallon pails
 - 2. A corrosion inhibitor of the nitrite-borate type equal to Nalco 2534.
 - 3. Maintained at a nitrite residual of 600 – 800 ppm in chilled loops and 1000-1500 in hot loops.
 - 4. With effective copper and black iron corrosion inhibitors.
 - 5. Form a protective film to prevent corrosion and scale formation.
 - 6. Have colored dye to indicate presence.
 - 7. Compatible with all system elements.
- D. Multiple chemicals used in a common system shall be compatible.

PART 3 - EXECUTION

3.1 INSTALLATION/START-UP

- A. In accordance with manufacturer's recommendations.
- B. Anchor the chemical filter feeder to a concrete housekeeping pad using wedge type expansion anchors.
- C. Clean and flush closed loops systems.
 - 1. Clear water flush systems before introducing chemical cleaners.
 - 2. Chemical cleaner shall be introduced into the systems to remove construction related oils, greases, threading compounds, and silt.
 - 3. Chemical Cleaner shall passivate and pre-film pipe system.

3.2 WATER ANALYSIS

- A. The chemical treatment agency shall provide the services of a testing laboratory to

perform a site water analysis. As a minimum, conduct the following tests in accordance with ASTM standards and to the satisfaction of the Owner/Architect/Engineer.

1. Silica in water and wastewater.
 2. Acidity or alkalinity of water.
 3. Iron in water.
 4. Hardness of water.
 5. Ph of water.
 6. Particulate and Dissolved Matter, Solids or Residue in Water.
 7. Turbidity in water.
 8. Corrosivity of water in absence of heat transfer.
 9. Standard practices for sampling water.
- B. Take water samples in accordance with ASTM.
- C. Prepare a test report in accordance with ASTM for each of the tests conducted.
- D. Submit the test reports to the Architect/Engineer.

3.3 CHEMICAL TREATMENT

- A. The chemical treatment agency shall provide complete services necessary for chemically cleaning and treatment the following systems:
1. Chilled water.
 2. Hot water.
- B. The chemical treatment agency shall provide, but not be limited to the following:
1. Equipment and installation.
 2. Chemicals.
 3. Analytical and testing work.
 4. Inspection.
 5. Calculations.
 6. Assistance to the trade installing the piping.
 7. Instruction to Owner.
- C. Determine which chemicals to use from the results of site water analysis. Provide the chemical necessary to achieve the desired water condition.
- D. Examine and supervise flushing and pipe cleaning operations and verify that the systems are clean, free of debris and rust and other construction materials before starting water treatment.
- E. After the piping has been flushed, cleaned, rinsed and charged with chemicals, then start-up and operate the chemical treatment equipment to provide steady, stable characteristics for the systems treated.
- F. During construction, instruct the Contractor in the field piping and wiring of chemical feeding equipment. If such piping and wiring details are not shown on the Contract Drawings, then provide all equipment, piping, wiring, instrumentation and chemicals to provide a complete and operating system without additional cost.
- G. After the chemical treatment is functioning as intended, the chemical treatment agency shall demonstrate to the Architect/Engineer the chemical treatment operation.

3.4 OWNER TRAINING

- A. A chemical treatment agency, in conjunction with the chemical treatment equipment manufacturer's factory representative, shall train the Owner to operate and maintain the chemical treatment system as a whole and in part for each piece of equipment.
- B. Furnish to the Owner a chemical treatment administration manual covering the chemical treatment program for each of the systems treated. The manual shall include, but not be limited to:
1. Name, address and telephone number of the chemical treatment agency and each of the equipment manufacturers.

2. Operation and maintenance manuals.
3. Test reports.
4. Chemical data sheets.
5. A narrative describing the chemical treatment program for each of the systems being treated.

3.5 TESTING AND INSPECTION

- A. After the systems have been accepted, the chemical treatment agency shall visit the site every month during the warranty period.
- B. During each visit:
 1. Check and adjust the chemical treatment equipment.
 2. Check the chemistry of the treated system to confirm the chemicals are maintaining the system as intended.
 3. Advise and instruct the Owner on operational changes made to the chemical treatment program.
 4. Take a water sample of each system being chemically treated and have the samples tested by a testing laboratory. Prepare a report for each water sample and submit it to the Owner. Include in the test report the changes that need to be made to the chemical treatment program.
 5. Maintain complete records of the treatment program for each system at the project site. Keep the records in a hardbound manual with the building manager. A second copy shall be maintained by the agency for the agency's records.
- C. Routine visits must be coordinated with the Owner.
- D. Send copy of monthly report to Engineer for Verification.

END OF SECTION

**SECTION 23 3113
DUCTWORK**

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Duct construction, support and accessories. Dimensions shown on the drawings are free area dimensions.

1.2 RELATED WORK

- A. Division 23 Mechanical
 - 1. Air Devices
 - 2. Air Handling Units
 - 3. Insulation
 - 4. Terminal Units
 - 5. Fan Coil Units
 - 6. Fans
 - 7. Testing, Balancing and Adjusting (TAB) of Environmental Systems
- B. Division 9 – Finishes, Painting and Color Coding

1.3 QUALITY ASSURANCE

- A. The intent of ductwork specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide ductwork in accordance with the specifications for each type of service.
- B. An approved contractor for this work under this division shall be:
 - 1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
 - 2. Able to furnish evidence of having contracted for and installed not less than 5 systems of comparable size and type that have served their owners satisfactorily for not less than 5 years.
- C. Duct cleaning: Oil film on sheet metal should be removed before shipment to site. On-site, inspect ducts to confirm that no oil film is present. Remove any oil. If ducts contain dust and dirt, clean them immediately, prior to substantial completion and prior to using the ducts to circulate air. HVAC system components or duct work may only be cleaned, coated, or have applied to its surface disinfectants, pesticides or biocides that are registered and particularly labeled for use in HVAC systems by state and federal EPA.

1.4 GUARANTEE

- A. Guarantee ductwork for 1 year from the date of substantial completion. The guarantee covers workmanship, noise, chatter, whistling, or vibration. Ductwork shall be free from pulsation under conditions of operation.

1.5 CONTRACTOR COORDINATION

- A. Erect ducts in the general locations shown, but conform to structural and finish conditions of the building. Before fabricating any ductwork, check the physical conditions at the job site and make necessary changes in cross sections, offsets, and similar items, whether they are specifically indicated or not.
- B. Coordinate location of ductwork with structural members and Architectural drawings and requirements.

1.6 SHOP DRAWINGS AND SAMPLES

- A. Submit shop drawings of all ductwork layouts, including enlarged plans and elevations of all air handling equipment, and submit details of duct fittings, including particulars such

as gauge sizes, welds, and configurations prior to starting work.

- B. Submit product data and sealing materials to be used.
- C. Submit sound attenuation data.
- D. Submit shop drawings in plan, elevation and sections, and three-dimensional view showing equipment in mechanical equipment areas.

PART 2 - PRODUCTS

2.1 STANDARDS AND CODES

- A. Except as otherwise indicated, sheet metal ductwork material and installation shall comply with the latest edition of SMACNA HVAC Duct Construction Standards. Air distribution devices (such as dampers) included in this specification shall comply with the latest applicable SMACNA Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems and NFPA 90A.

2.2 DUCT MATERIAL AND CONSTRUCTION

- A. Except for the special ducts specified below use lock forming quality prime galvanized steel sheets or coils up to 60" wide. Stencil each sheet with gauge and manufacturer's name. Stencil coils of sheet steel throughout on 10' centers with gauge and manufacturer's name. Provide certification of duct gauge and manufacturer for each size duct.
- B. Rectangular low and medium pressure duct constructed of sheet metal in accordance with the latest edition of SMACNA HVAC Duct Construction Standards.
- C. Medium pressure oval and round ductwork shall be spiral seam. Spiral lock-seam SMACNA Type RL-1. Fittings shall be welded construction.
 - 1. Galvanized
- D. Low pressure round ducts shall be shop fabricated with snap lock longitudinal seams. Ducts shall be constructed for a minimum of 2" w.g. static pressure.
- E. Dishwasher Hood Exhaust System: Welded 304 Stainless steel.
- F. Shower Area Exhaust Systems: Welded 304 Stainless steel.
- G. Kitchen exhaust duct: Welded Black steel, minimum 16 gauge

2.3 ACOUSTICAL DUCT

- A. Duct and fittings:
 - 1. Double wall acoustically treated.
 - 2. Annular space packed with fiberglass insulation.
 - 3. Perforated metal liner to provide specific acoustic impedance
 - 4. Insulation 1.0 pcf. 1 inch thick
 - 5. United McGill Acousti-K27 spiral lockseam or approved equal
 - 6. Material as indicated below:
 - a. Paintable Galvanized Steel
- B. Pressure rating and tests as specified for single wall ductwork.

2.4 DUCT SEALING OF SEAMS AND JOINTS

- A. Follow seal classification as indicated in Table 1-2 of SMACNA "HVAC AIR DUCT LEAKAGE TEST MANUAL". Use seal class A for 4" w.g. static. All longitudinal and transverse joints and seams shall be sealed by use of a fireproof, non-hardening, and non-migrating elastomeric sealant. With the exception of continuously welded joints and machine made spiral lock seams, joints and seams made air tight with duct sealer.
 - 1. Indoor applications – Foster 32-14
 - 2. Outdoor applications – Foster 32-17

2.5 FLEXIBLE DUCT LOW PRESSURE

- A. Construction:
 - 1. Continuous galvanized spring steel wire helix, with reinforced metalized cover
 - a. The fabric shall be mechanically fastened to the steel helix without the use of adhesives.
 - 2. UL 181 Class I air duct label
 - 3. Reinforced vapor barrier jacket
 - 4. Rated for use at system pressure (6" wc minimum)
 - 5. Flexible duct connections from lateral taps to variable volume boxes or terminal boxes shall be rated at twice the maximum pressure rating of the medium pressure system.
- B. Fire hazard classification:
 - 1. Flame spread rating 25 maximum.
 - 2. Smoke developed rating 50 maximum.
- C. Thermal characteristics:
 - 1. R-6 BTU/hr/sq. ft./°F (when located in a conditioned plenum)
 - 2. R-8 BTU/HR/Sq.Ft./°F (when located in an unconditioned plenum)
 - 3. 2" minimum wall thickness insulation with 1" overlap
- D. Acceptable manufacturers:
 - 1. Flexmaster
 - 2. Peppertree Air Solutions

2.6 FLEXIBLE DUCT MEDIUM/HIGH PRESSURE

- A. The duct shall be constructed of a heavy coated fiberglass cloth fabric supported by helical wound galvanized steel. The fabric shall be mechanically fastened to the steel helix without the use of adhesives.
- B. The internal working pressure rating shall be at least as follows with a bursting pressure of at least two times the working pressure:
 - Positive: 12" w.g.
 - Negative: 5" w.g.
- C. The duct shall be rated for a velocity of at least 5500 fpm.
- D. Suitable for operating temperature range of -20°F to +250°F.
- E. Factory insulate the flexible duct with fiberglass insulation.
 - 1. R-6 BTU/hr/sq. ft./°F (when located in a conditioned plenum)
 - 2. R-8 BTU/HR/Sq.Ft./°F (when located in an unconditioned plenum)
 - 3. 2" minimum wall thickness insulation with 1" overlap
- F. Cover the insulation with a fire retarding polyethylene vapor barrier jacket having a permeance of not greater than 0.10 perms when tested in accordance with ASTM E96, Procedure A.
- G. Acceptable manufacturers:
 - 1. Flexmaster
 - 2. Peppertree Air Solutions

2.7 FIRE DAMPERS

- A. Fire dampers for required wall ratings that are 95% minimum free area. Provide Type B or Type C UL dampers for low, medium and high-pressure rectangular, square or round ducts. Dampers shall be activated by a fusible link designed to react at 165°F. Install per manufactures recommendations to provide a UL assembly. Provide sealed sleeve to meet desired leakage performance.
- B. Acceptable Manufacturers:
 - 1. Ruskin
 - 2. Prefco Products
 - 3. Air Balance

4. Greenheck, Inc.
5. Nailor Industries
6. Pottorff
7. Price

2.8 CEILING RADIATION DAMPERS

- A. Ceiling Radiation Dampers at location shown on plans constructed and tested in accordance with the current edition of UL555C of a minimum 22 gauge (0.8) blades, hinged in the center and held open with a 165° fusible link. Maximum blade height in the open position shall be 10" overall regardless of damper area. Maximum distance between blades held in the open position shall be 1-1/4" for units not requiring blade insulation and 1/4" for units with sheetrock blade insulation. Blades requiring radiation protection insulation shall utilize sheetrock. Refractory Ceramic or Mineral Wool Fiber is not allowed in the air stream. Radiation insulation outside of the air stream shall be Mineral Wool Fiber only. Ceramic Fiber Material is not approved for use. Units shall be constructed of a minimum 20-gauge (0.9) frame welded at all seams.
- B. Acceptable Manufactures
 1. Ruskin
 2. Prefco
 3. Air Balance
 4. Phillips
 5. Safe-Air
 6. Nailor Industries

2.9 WALL LOUVERS

- A. Coordinate with Architectural Drawings.
- B. All louver frames shall be a minimum of 0.08" extruded aluminum. All blades shall be a minimum of 0.081" extruded aluminum. Beginning point of water penetration at 0.01 oz/sq.ft. Shall be a minimum of 800 ft/min.
- C. Provide all louvers with removable aluminum bird screen with 1/4" mesh.
- D. All louvers shall be certified to meet the wind zone requirements of project location.
- E. Acceptable manufacturers:
 1. American Warming and Ventilation
 2. Arrow
 3. Greenheck
 4. NCA
 5. Pottorff
 6. Ruskin

2.10 FLUES FOR POWER EXHAUST AND HIGH EFFICIENCY BOILERS AND WATER HEATERS

- A. Double wall air insulated positive pressure chimney equal to Metalbestos, Van-Packer, Schebler or Metal-Fab. Chimney shall be rated for 550°F maximum flue gas temperature and with a UL tested pressure rating of 40 inches w.c. The interior pipe shall be constructed of AL 29-4C stainless steel and the exterior pipe shall be constructed of 304 stainless steel. Stack system shall be complete with a one inch air gap between inner liner and outer cover. Chimney shall be constructed and installed per UL-1738 and NFPA-211. All accessories shall be made by the same manufacturer and designed to be a part of a positive pressure chimney system.

2.11 DUCT LINING

- A. Duct lining shall be 1" thick, 1-1/2 lb. density, flexible lining coated on the air stream side to reduce attrition. Liner shall be Schuler Lina-Coustic, Certain-Teed Ultralite, or equal meeting requirements of NFPA 90-A. Provide I.A.Q. rated liner.

2.12 VOLUME DAMPERS

- A. Manual balancing dampers that meet or exceed the following minimum construction standards:
 - 1. Frame 16-gauge
 - 2. Blades 16-gauge
 - 3. Bearings corrosion resistant
 - 4. Concealed linkage
 - 5. Opposed blade dampers

- B. Acceptable manufacturer:
 - 1. Ruskin Model MD-35 or approved equal, by
 - 2. Arrow
 - 3. American Warming and Ventilating
 - 4. Nailor Industries
 - 5. Pottoroff

2.13 ACCESS DOORS

- A. Round spin-in door of galvanized steel.
 - 1. Fire proof sealing gaskets and quick fastening locking devices
 - 2. Insulated door
 - 3. Conform to the requirements of the NFPA
 - 4. Identification and use of each access door
 - 5. UL label to match the construction in which it is installed
 - 6. Cable attached to door and outer frame
 - 7. Low leakage Access Door

- B. Acceptable Manufacturer
 - 1. Flex master, Inspector Series
 - 2. Approved Equal

2.14 COMBINATION FIRE/SMOKE DAMPERS

- A. Combination fire/smoke dampers meeting the following requirements:
 - 1. Each combination fire/smoke damper shall be 1-1/2 hour fire rated under UL Standard 555, 4th Edition, and shall be further classified by Underwriters Laboratories as a leakage Rated Damper for use in smoke control systems under the latest version of UL555S, and bear a UL label attesting to same. The damper manufacturer shall have tested, and qualified with UL, a complete range of damper sizes covering all dampers required by this specification. Testing and qualifying a single damper size is not acceptable. The leakage rating under UL555S shall be Leakage Class II.
 - 2. The damper frame shall be a minimum of 16 gauge, galvanized steel, formed into a structural hat channel shape with tabbed corners for reinforcement, as approved in testing by Underwriters Laboratories. Bearings shall be integral high surface area non-electrolytic materials construction to incorporate a friction free frame blade lap seal, or molybdenum disulfide impregnated stainless steel or bronze oilite sleeve type turning in the damper frame. The dampers shall be opposed blade type. The blades shall be constructed with a minimum of 16-gauge galvanized steel. The blade edge seal material shall be able to withstand 450°F. The jamb seals shall be flexible stainless steel compression type.
 - 3. As part of the UL qualification, dampers shall have demonstrated a capacity to operate (open and close) under HVAC system operation conditions, with pressures of at least 4" water gauge in the closed position, and 2,000 fpm air

- velocity in the open position.
- 4. Each combination fire/smoke damper shall be equipped with a controlled 7 to 15 second heat-actuated release device. The electric EFL shall close and lock the fire/smoke damper during test, smoke detection, power failure or fire conditions through actuator closure springs. To prevent duct and HVAC component damage, the damper shall at all times be connected to the actuator for controlled closure in not less than 7 seconds and no more than 15 seconds. Instantaneous damper closure is unacceptable. After exposure to high temperature of fire, the damper must be inspected prior to reset to ensure proper operation. Release temperature is 165°F.
- 5. Provide UL555S qualified electric actuator at 120 VAC.
- 6. Provide air-foil type blades.
- B. Provide integral sleeves
- C. Acceptable Manufacturers:
 - 1. Ruskin
 - 2. Air Balance, Inc.
 - 3. Greenheck, Inc.
 - 4. Nailor Industries
 - 5. Pottoroff
 - 6. Price

2.15 SMOKE DAMPERS

- A. Smoke dampers meeting the following requirements.
 - 1. Each smoke damper shall be classified by Underwriters Laboratories as a leakage Rated Damper for use in smoke control systems under the latest version of UL555S, and bear a UL label attesting to same. The damper manufacturer shall have tested, and qualified with UL, a complete range of damper sizes covering all dampers required by this specification. Testing and qualifying a single damper size is not acceptable. The leakage rating under UL555S shall be Leakage Class II.
 - 2. The damper frame shall be a minimum of 16 gauge, galvanized steel, formed into a structural hat channel shape with tabbed corners for reinforcement, as approved in testing by Underwriters Laboratories. Bearings shall be integral high surface area non-electrolytic materials construction to incorporate a friction free frame blade lap seal, or molybdenum disulfide impregnated stainless steel or bronze oilite sleeve type turning in the damper frame. The dampers shall be opposed blade type. The blades shall be constructed with a minimum of 16 gauge, galvanized steel. The blade edge seal material shall be able to withstand 450°F. The jamb seals shall be flexible stainless steel compression type.
 - 3. As part of the UL qualification, dampers shall have demonstrated a capacity to operate (open and close) under HVAC system operation conditions, with pressures of at least 4" water gauge in the closed position, and 2,000 fpm air velocity in the open position.
 - 4. Provide UL555S qualified electric actuator at 120 VAC.
 - 5. Provide air-foil type blades.
- B. Provide integral sleeves.
- C. Acceptable Manufacturers:
 - 1. Ruskin
 - 2. Air Balance, Inc.
 - 3. Greenheck, Inc.
 - 4. Nailor Industries
 - 5. Pottoroff

6. Price

2.16 DIFFUSER FITTINGS LOW PRESSURE TAPS

- A. Fitting shall meet or exceed the following minimum construction standards:
1. Conical with a base diameter two inches larger than the tap diameter.
 2. Construct fitting and damper of galvanized steel in accordance with ASTM A 527, G90 finish.
 - a. Fitting with a 3/16-inch high stop bead approximately 2-1/2-inches from the discharge end of the fitting
 - b. Provide the fitting with a butterfly damper, damper rod, end bearings and heavy duty locking quadrant.
 - c. Size the length of the straight section of the fitting to match the damper blade diameter. Center the damper blade in the straight section.
 3. Match the fitting body gauge to the SMACNA duct gauge, but not less than:
 - a. Through 8 inches: 26 gauge; Damper blade 22 gauge
 - b. 10 inches and 12 inches: 24 gauge; Damper blade 22 gauge
 - c. 14 inches and 16 inches: 22 gauge; Damper blade 22 gauge
 - d. 18 inches and 20 inches: 20 gauge; Damper blade 20 gauge
 4. Fasten damper blade to a 3/8 X 3/8 continuous square rod with minimum (2) galvanized U-bolts.
 5. Support the damper rod to the fitting with airtight nylon end bushings / bearings.
 6. Provide the damper with a self-locking regulator and handle.
 7. Provide a 2" sheet metal stand-off to extend the regulator.
 8. Flex duct grip area – 2 inches behind retaining bead
 9. Flex duct retaining bead – 1 inch from end
 10. Conical length of at least 3 inches
 11. Barrel length of at least 9 inches

2.17 AUXILIARY DRAIN PANS

- A. Galvanized steel, same gauge and same bracing or cross breaks as a duct with same dimensions. Sides of pan turned up to 1-1/2", all joints soldered watertight. Pan is to be large enough to complete cover drip lines of unit.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Use construction methods and requirements as outlined in SMACNA HVAC Duct Construction Standards as well as SMACNA Balancing and Adjusting publications, unless indicated otherwise in the specifications. Refer to details on the drawings for additional information.
- B. Reinforce ducts in accordance with recommended construction practice of SMACNA. Provide additional reinforcement of large plenums as required to prevent excessive flexing and or vibration.
- C. Cross break or bead sheet metal for rigidity, except ducts that are 12" or less in the longest dimension.
- D. Where ducts pass through walls in exposed areas, install suitable escutcheons made of sheet metal angles as closers.
- E. At locations where ductwork passes through floors, provide watertight concrete curb around penetration.
- F. Support ducts where passing through floors with galvanized steel structural angles of adequate bearing surface.
- G. Metal or lined ductwork exposed to view through grilles, registers, and other openings shall be painted flat black. Do not install grilles, registers, or similar items until painting is complete.

- H. Fire Dampers shall be installed per manufacturer's recommendations to create a UL rated assembly.
- I. Install end bearing at all location where damper shaft penetrates duct wall.
- J. Clean duct to remove accumulated dust. Ducts shall be closed on ends between phases of fabrication to assure that no foreign material enters the ducts.

3.2 DUCTWORK

- A. Construct rectangular ducts and round ducts in accordance with the latest SMACNA HVAC Duct Construction Standards. Use the static pressure specified on the air handling unit schedule or fan schedules as a minimum for duct construction. All ductwork between the variable volume air handling units and the terminal units shall be constructed to the medium pressure ductwork specification.
- B. Provide adjustable, galvanized splitter-dampers, pivoted at the downstream end with appropriate control device at each supply duct split.
- C. For branch ducts wider than 18", and when shown on drawings provide extractors with an appropriate control device at each rectangular zone or branch supply duct connection. Provide controllers for extractors. Branch ducts shall have a 45° angle in the direction of flow. Do not provide extractor at branch ducts to sidewall registers where the registers are within 10 feet of the main duct.
- D. Shop manufactured curved blade scoops may be used for branch duct takeoffs up to 18" wide. Taper scoop blade to the end, to prevent any sagging that may cut into, or damage duct liner if specified during operation.
 - 1. Construct shop manufactured scoops and splitter blades of galvanized sheet metal 2 full gauges heavier than equivalent sheet metal gauge of branch duct (up to 16 gauge).
 - 2. Check extractors, scoops and splitter blades thoroughly for freedom of operation. Oil bearing points before installing.
- E. Use pushrod operator with locking nut and butt hinges assembly.
- F. Provide opposed-blade volume dampers with an appropriate control device in each of the following locations:
 - 1. Return air ductwork
 - 2. Outside air branch duct
 - 3. Exhaust branch duct
 - 4. Exhaust connections to hoods except kitchen grease hoods or equipment
 - 5. In each zone at multi-zone unit discharge installed downstream of duct mounted re-heat coils
 - 6. At each outside air and return air duct connection to plenum of constant volume units
 - 7. At discharge side of constant volume boxes
 - 8. Where otherwise indicated or required for balancing coordinate location of additional dampers required by TAB Contractor.
 - 9. Provide multi-blade dampers when blade width exceeds 12". Provide end bearing where damper shaft penetrates duct wall.
- G. Elbows:
 - 1. Rectangular: Where square elbows are shown, or are required for good airflow, provide and install single-wall or airfoil turning vanes. Job-fabricated turning vanes, if used, shall be single-thickness vanes of galvanized steel sheets of the same gauge metal as the duct in which they are installed. Furnish vanes fabricated for the same angle as the duct offset. The use of radius elbows with a centerline radius of not less than 1-1/2 times the duct width may be provided in lieu of vaned elbows where space and air flow requirements permit.
 - 2. Round Oval Duct. Provide elbows with a centerline radius of 1-1/2 times the duct diameter or duct width. For round ducts, furnish smooth elbows or 5 piece, 90°

- elbows and 3 piece, 45° elbows.
- H. For control devices concealed by ceilings, furring, or in other inaccessible locations, furnish extension rods and appropriate recessed-type Young regulators, mounted on the surface of the ceiling or the furring, unless specified, or shown otherwise. Provide with chrome plated cover plates. Use only one mitered gear set for each control device.
 - I. Install streamline deflectors at any point where dividing a sheet metal duct around piping or where other such obstruction is permitted. Where such obstructions occur in insulated ducts, fill space inside streamliner and around obstructions with glass fiber insulation.
 - J. Insulated Flexible Duct:
 - 1. Install in accordance with manufacturer's instructions, and the terms of its UL listing. Duct shall not exceed 6' in length. Make connections by use of sheet metal collars and stainless steel circular screw clamps. Clamps shall encircle the duct completely and be tightened with a worm gear operator to the point that will provide an airtight connection without unnecessary deformation of the duct. Provide one clamp on flexible duct and one clamp on external insulation. Vapor barrier jacket shall be tucked inside to conceal insulation material.
 - 2. Construct bends over 45° with sheet metal elbows.
 - K. Duct Supports:
 - 1. Horizontal ducts up to 40". Support horizontal ducts up to and including 40" in their greater dimension by means of #18 U.S. gauge galvanized iron strap hangers attached to the ducts by a minimum of two locations per side by means of screws, rivets or clamps, and fastened to inserts with toggle bolts, beam clamps or other approved means. Place supports on at least 8' centers. Use clamps to fasten hangers to reinforcing on sealed ducts.
 - 2. Horizontal ducts larger than 40". Support horizontal ducts larger than 40" in their greatest dimension by means of hanger rods bolted to angle iron trapeze hangers. Place supports on at least 8' centers in accordance with SMACNA Standards.
 - 3. Support vertical ducts where they pass through the floor lines with 1-1/2" x 1-1/2" x 1/4" angles for ducts up to 60". Above 60", the angles shall be increased in strength and sized on an individual basis considering space requirements.
 - 4. Supports shall be suspended from structural or by independent support. Do not support from structural bridging. Upper attachments should be selected with a safety factor of 4 or 5 times actual load conditions and subject to Engineers approval. Double wrap straps over open web of joist.
 - L. Branch connections for medium pressure ductwork shall be made with a conical lateral. Field installed conical branch ducts shall be minimum 20-gauge galvanized sheet metal, "Everdur" welded and coated with "Galvabar".

3.3 PLENUMS

- A. Return air plenums shall be rectangular galvanized sheet metal ductwork.
- B. Fabricate plenums upstream of fan of 16-gauge material.
- C. Fabricate plenums upstream of filters minimum 18-gauge material.

3.4 FLEXIBLE CONNECTIONS

- A. Where ducts connect to fans or air handling units that are not internally isolated, make flexible airtight connections using "Ventglas" fabric. The fabric shall be fire-resistant, waterproof and mildew resistant with a weight of approximately 30 ounces per square yard. Provide a minimum of 1/2" slack in the connections, and a minimum of 2-1/2" distance between the edges of the ducts. Also, provide a minimum of 1" slack for each inch of static pressure on the fan system. Fasten fabric to apparatus and to adjacent ductwork by means of galvanized flats or draw bands. Where connections are made in outdoor locations, seal fabric to metal with mastic.

3.5 ACCESS DOORS

- A. Install ductwork access doors as noted below, arranged for convenient access. Stencil each door for specific use. Install access doors in each of the following locations:
 - 1. Fire Dampers
 - 2. Smoke Dampers
 - 3. Smoke/fire Dampers
 - 4. Outside Air Dampers
 - 5. Duct Mounted Coils (up-stream and downstream)
 - 6. Control Dampers
- B. Size access door 1" smaller than ductwork.
 - 1. Available Sizes: 8", 10", 12", 18", 24"
- C. Construct access door air tight, and conform to recommendations of NFPA and SMACNA.
- D. Demonstrate suitability of access for the intended purpose. Install multiple access doors as required.

3.6 DUCT LINING

- A. Install glass fiber acoustical lining where shown on drawings. Secure to duct surfaces with Foster 85-62 / 85-60 or Childers CP-125-1 / CP-127 adhesive and sheet metal fasteners on 12" centers. Coat exposed edges and leading edges of cross-joints with adhesive.
- B. Provide metal nosing that is either channeled or "Z" profiled or are integrally-formed from the duct wall securely installed over transversely oriented liner edges facing the air stream at fan discharge and at any interval of lined duct preceded by unlined duct.
- C. Refer to Insulation & Liner Detail on drawings for locations requiring liner to be installed.
- D. Do not install liner in multi-zone unit ductwork.

3.7 SEALING OF SEAMS AND JOINTS

- A. Seal supply, return, exhaust and outside air duct systems.

3.8 FLUES

- A. Provide and install flues for all gas fired equipment.
- B. Refer to plans for all related locations.
- C. Contractor is responsible for coordinating stack sizing, stack drains, stack test ports, stack termination fittings and all other required fittings with the selected equipment manufacturers.
- D. All fittings and accessories shall be manufactured by the flue manufacturer. The flue shall be installed per manufacturer's instruction.
- E. Terminate flues at height above roof to prevent flue gas from entering the building.

3.9 DISHWASHER HOOD EXHAUST SYSTEM

- A. All material and fittings shall be 304 Stainless steel, welded joints, watertight construction. Grade horizontal duct 1/4" per lineal foot to drain toward the washer.

3.10 SHOWER AREA EXHAUST SYSTEM

- A. All material and fittings shall be 304 Stainless steel, welded joints, watertight construction. Grade horizontal duct 1/4" per lineal foot slope down to grille connection. Install in accordance with Fig. 2-21 of SMACNA HVAC Duct Construction Standards.

3.11 KITCHEN EXHAUST DUCT

- A. All material and fittings shall be minimum 16 gauge, coated black steel to prevent rusting. All seams and joints in the kitchen exhaust duct, and penetrations of the hood enclosure

to its lower outermost perimeter that directs and captures grease-laden vapors and exhaust gases shall have a liquid tight continuous external weld. All ducts shall be installed without forming dips or traps that might collect residues. Provide 18" x 18" or equal area at each elbow and as required for cleaning access, in direction of air flow. UL Listed access panel shall be located on the vertical wall of the duct 1-1/2" from the bottom of duct and shall be fitted with two handles, grease and air tight fitting access door and latch. All interior surfaces of ducts shall be accessible for cleaning and inspection purposes. Duct shall maintain minimum 1/4" per lineal foot slope to the exhaust hood. Provide duct over lay at the roof curb for a complete seal. Install kitchen exhaust system per local authority. In the absence of a local authority, the requirements of the Uniform Mechanical Code and NFPA 96 shall govern.

3.12 FUME HOOD EXHAUST SYSTEM

- A. All material and fittings shall be 304 stainless steel construction.

3.13 ACOUSTICAL DUCT

- A. Install in the following locations:
 - 1. Where indicated on the drawings

3.14 SCREENS

- A. Furnish and install screens on all duct, fan, etc., openings furnished by the Contractor that lead to, or are, outdoors; screens shall be No. 16 gauge, one-half inch (1/2") mesh in removable galvanized steel frame. Provide safety screens meeting OSHA requirements for protection of maintenance personnel on all fan inlets and fan outlets to which no ductwork is connected.

3.15 CONNECTIONS TO LOUVERS

- A. Make watertight connections to all louvers. Ductwork behind louver shall have watertight soldered joints for a minimum of three feet and be sloped to bottom of louver. Lap duct to be over bottom louver blade where possible.
- B. Where plenums are installed on inside of louver, construct such that bottom of plenum will lap over bottom blade of louver to drain any water that may enter.

3.16 PLENUMS

- A. Construct plenums with galvanized steel framing members and galvanized sheet steel, cross braced and rigidly braced with galvanized angles. Gauges and bracing shall conform to SMACNA recommendations for ductwork of like sizes. Openings for fans, access doors, etc., shall be framed with galvanized steel angles.
- B. Provide access doors.

3.17 AUXILIARY DRAIN PANS

- A. All condensate producing equipment installed above ceilings and in central plant area shall be provided with a welded stainless steel secondary drain pan installed below equipment entirely and extend a minimum of 4" beyond equipment footprint.
- B. With 3/4" welded nipple.
- C. Piped to local floor drains or floor sinks.

3.18 TESTING OF LOW PRESSURE DUCTWORK

- A. Test ductwork for leaks before concealing. Maximum allowable leakage is 5% of total airflow.
- B. Provide equipment necessary for performing tests, including rotary blower large enough to provide required static pressure at allowed CFM quantity, certified orifice section with proper papers, traceable serial numbers and pressure vs CFM leakage rate scale, U-tube

- C. gauge board complete with cocks, tubing, and inclined manometer for leakage rates. Mains: Test mains after risers and branches are tied in and all equipment set. Close runout connections and place fan in operation. Provide pressure in mains at 1-1/2 times design pressure. Visually inspect joints. Repair leaks detected by sound or touch. Release mains for completion after joints are tight.
- D. Ductwork down stream of terminal boxes, return, exhaust, and outside air ducts are to be visually inspected.

3.19 TESTING OF MEDIUM AND HIGH PRESSURE DUCT

- A. As the project progresses, test the ductwork in sections.
- B. Provide equipment necessary for performing tests, including rotary blower large enough to provide required static pressure at allowed CFM quantity, certified orifice section with proper papers, traceable serial numbers, and pressure vs. CFM leakage rate scale, U-tube gauge board complete with cocks, tubing, and inclined manometer for leakage rates.
- C. Finally as a complete system, test ductwork at a minimum of 2.5" with a maximum allowable leakage of 1% of the total design supply airflow.
- D. Test method as set forth in SMACNA "HVAC Duct Construction Standards".

END OF SECTION

**SECTION 23 3416
FANS**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install fans, including centrifugal, axial and propeller types, with supplemental equipment.

1.2 RELATED WORK

- A. Division 23 Mechanical:
 - 1. Ductwork
 - 2. Vibration Isolation
 - 3. Air Balance
 - 4. Electrical Provisions of Mechanical Work

1.3 PERFORMANCE

- A. Provide fan type, arrangement, rotation, capacity, size, motor horsepower, and motor voltage as shown. Fan capacities and characteristics are scheduled on the drawings. Provide fans capable of accommodating static pressure variations of +10% of scheduled design at the design air flow.
- B. Rate fans according to appropriate Air Moving and Conditioning Association, Inc. (AMCA), approved test codes and procedures. Supply fans with sound ratings below the maximums permitted by AMCA Standards. All fans provided must be licensed to bear the Certified Ratings Seal.
- C. Statically and dynamically balance all fans.
- D. Motors shall be sized so that they do not operate within the motor service factor.

1.4 SUBMITTALS

- A. Submit fan performance curves with system operating point plotted on curves.
- B. Submit manufacturer's printed installation instructions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Cook
- B. Greenheck
- C. Penn Barry Ventilator
- D. Twin City Fans

2.2 PROTECTIVE COATINGS

- A. Manufacturer's Standard. Apply to fans, motors and accessories, the manufacturer's standard prime coat and finish, except on aluminum surfaces or where special coatings are required.
- B. Galvanizing. After fabrication of the parts, hot-dip coat surfaces that require galvanizing. Where galvanizing is specified, a zinc coating may be used. After fabrication, apply the zinc coating and air-dry the coating to 95% pure zinc. Acceptable zinc coatings include Zincilate, Sealube, Amercoat, Diametcoat, or an approved equal.

2.3 SUPPLEMENTAL EQUIPMENT

- A. Motor Covers. Provide weatherproof motor covers for installations out of doors. Apply the same finish as used on the fan.
- B. Belt Drives:
 - 1. Unless otherwise specified for belt-driven fans, equip the fan motors with variable

- pitch sheaves. Select the sheave size for the approximate midpoint of adjustment and to provide not less than 20% speed variation from full open to full closed. Size drives for 150% of rated horsepower. Key the fan sheave to the fan shaft.
- 2. Nonadjustable motor sheaves may be used for motor sizes over 15 horsepower, at the Contractor's option. However, if changing a nonadjustable sheave becomes necessary to produce the specified capacity, the change must be made at no additional cost.
- 3. Provide belt guards and apply the same finish as used on the fan.
- 4. Oil and heat resistant, nonstatic type belts.
- 5. Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty, regreasable, ball type, in a pillow block, cast iron housing, selected for a minimum L50 life in excess of 200,000 hours at maximum catalog operating speed.
- C. Safety Disconnect Switch: Provide a factory-wired to motor, safety disconnect switch on each unit.
- D. Relief Vents and Air Inlets: Provide vents and inlets with aluminum frames and 1/2" mesh, galvanized bird screens. Include dampers where shown.
- E. Prefabricated Roof Curbs: Furnish prefabricated roof curbs as detailed. The minimum height is 14". Include a resilient pad on each roof curb so the equipment can be mounted on the top flange for proper seal. Coordinate roof slope and curb to ensure equipment is installed in level position. Provide double shell to protect insulation from damage.
- F. Where motorized damper is scheduled:
 - 1. The motor and damper are specified in the Building Management and Control System Specification.
- G. All fans are to be provided with a durable, deep etched, .025" thick, factory installed aluminum identification plate with the following information. Plates are to be furnished with four mounting holes.
 - 1. Fan mark as indicated on the Contract Drawings.
 - 2. Serial number
 - 3. Model number
 - 4. Capacity (CFM) and static pressure.
 - 5. Motor HP
 - 6. Motor Amps
 - 7. Manufacturer
 - 8. Motor phase
 - 9. Number of Belts/Make/Size
 - 10. Motor volts

2.4 VENTILATION AND EXHAUST FANS

- A. Provide the ventilation and exhaust fans shown on the drawings.
- B. Provide each motor with internal overload protection.
- C. Provide approved safety screen where inlet or outlet is exposed.
- D. Provide duct flanges where required for connections.
- E. Furnish kitchen hood exhaust fans with vented curb extension that meets NFPA 96, cleanout port, grease tap, curb seal, drain connection and hinge kit.
- F. Furnish supply fans with 1" aluminum, washable filter section.

2.5 ROOFTOP VENTILATION AND EXHAUST SYSTEMS

- A. Provide the rooftop ventilation and exhaust systems shown on the drawings.
- B. Provide each motor with internal overload protection.
- C. Components:
 - 1. Aluminum, stainless steel or plastic coated bird guard.
 - 2. Screws and fasteners of stainless steel or nonferrous material.

- 3. All aluminum construction unless indicated otherwise on fan schedule.
- D. Welded construction, corrosion resistant fasteners, minimum 16 gauge marine alloy aluminum.
- E. Aluminum base shall be continuously welded curb cap corners.

2.6 GRAVITY ROOF-TOP INTAKE AND RELIEF VENTS

- A. Provide the rooftop intake and relief vent systems shown on the drawings.
- B. Provide with aluminum, stainless steel or plastic coated bird guard.
 - 1. Screws and fasteners of stainless steel or nonferrous material
 - 2. All aluminum construction
- C. Welded construction, corrosion resistant fasteners, minimum 16-gauge marine alloy aluminum.
- D. Aluminum base shall be continuously welded curb cap corners.

2.7 OSCILLATING AIR CIRCULATOR FAN

- A. three speed CFM Low 1657 – CFM Medium 2060 – CFM High 3100
- B. Totally enclosed motor voltage – 120 Voltage – 60 Hz
- C. Cast Aluminum 20-inch diameter, three blade fan with OSHA Guard
- D. Wall Mounted
- E. Factory wired 10', 3 conductor with ground molded plug
- F. Acceptable Manufacturer: Dayton 4PRV7 or approved equal

2.8 AUXILIARY ANGLE FILTER

- A. Provide a duct mounted inline low velocity angled filter box for the outside air supply systems.
- B. Filter box shall be upstream of any ductwork taps to VAV boxes.
- C. Maximum pressure drop shall be 0.5 inches static pressure.
- D. Provide continuous filter rails and a double wall hinged access door to allow easy filter replacement.
- E. Filter box shall be installed with a maximum height of 6'-0".
- F. Standard sizes 16x20x2, 16x25x2, 20x20x2, 20x25x2 only.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fans according to the manufacturer's instructions and in the locations shown on the drawings.
- B. Do not operate fans or fan powered devices for any purpose until ductwork is clean, filters in place, bearings lubricated and the fan has been run under observation.
- C. Roof mounted fans and gravity roof-top intake and relief vents shall be secured to the curb with stainless steel lag screws at a minimum of 6-inches on center. Follow manufacturer's installation instructions if they are more stringent. Install roof mounted equipment in a level position. Units shall be seated on properly sized curb. Gap between base of the fan and top of the curb shall be sealed with neoprene 1" x ¼" gasket. Gasket shall be glued or attached with pressure sensitive adhesive.
- D. Install curbs and equipment in level position.
- E. Ceiling mounted in-line centrifugal blowers
 - 1. Shall be suspended from structure with 1/2-inch zinc plated all-thread rods secured to structure.
 - 2. Provide sub-structure where required.
 - 3. Mount bottom of fan no more than 18-inches above the finished ceiling height.

3.2 EXTRA MATERIALS

- A. Provide two sets of belts for each fan, not including the set installed on the fans. Tag set

to identify fan.

END OF SECTION

SECTION 23 3617
DUAL DUCT VARIABLE VOLUME TERMINAL UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install dual duct variable volume terminal units with mixing attenuator, including hangers, controls and other required elements.

1.2 RELATED WORK

- A. Division 23 - Mechanical.
 - 1. Ductwork
 - 2. Air Balance
 - 3. Electrical Requirements for Mechanical Work
 - 4. Building Management and Control System

1.3 COOPERATION WITH OTHER TRADES

- A. Coordinate this work with work under Division 26 Electrical, to ensure that intended functions of lighting and air systems are achieved.
- B. Coordinate the primary (input) voltage with the electrical power source. Refer to the Electrical Drawings for specific requirements.
- C. Coordinate multi-point sensor locations with Building Management Control System contractor.

1.4 SUBMITTALS

- A. Submit product data for control devices, terminal boxes, and similar equipment for review prior to placement of purchase order.
- B. Submit for each box the following information:
 - 1. Box size
 - 2. Inlet size
 - 3. Box number
 - 4. Box designation
 - 5. Minimum / Maximum CFM

1.5 QUALITY ASSURANCE

- A. Make air flow tests and sound level measurements in accordance with applicable ASHRAE Standards 130-96 and ARI 880-98.
- B. Manufacturer shall certify cataloged performance and ensure correct application of terminal units.
- C. Sound power levels to occupied space shall not exceed the NC levels specified in 23 05 47 as calculated using ARI 885-98 Appendix E attenuation factors for mineral tile ceiling.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Titus.
- B. Krueger
- C. Price
- D. Nailor
- E. Metalaire

2.2 BOX CONSTRUCTION

- A. Galvanized 20-gauge steel casing with suspension lugs.
- B. Lined with minimum 1.5 PCF / 1.5" thick fiber free thermal and acoustical insulation.

1. Flame spread not higher than 25.
 2. Smoke developed rating not higher than 50.
 3. Condensation on the exterior of the box is not approved.
 4. Coat all cut edges of liner with NFPA approved sealant.
 5. Lining shall pass UL 181, NFPA 90A and ASTM C 665.
- C. Provide access to controls without disturbing duct connections. Limit the size of access doors to 24 inches. Where required, provide multiple access doors. Gasket each door in the unit casing.
- D. Components shall be constructed of corrosion resistant materials.
- E. Casing leakage shall not exceed 2.0% of scheduled design airflow at 3.0" WG interior casing pressure.
- F. Seal casing joints with approved adhesive if required to meet the maximum casing leakage rate.
- G. The maximum overall height of the dual duct variable air volume unit shall not exceed available ceiling space.
- H. Maximum static pressure through box shall not exceed 0.2" w.g.
- I. Maximum velocity through inlets should not exceed 2,000 fpm.

2.3 COMPONENTS

- A. Primary variable air volume damper that controls the air quantity in response to a space sensor.
- B. Multi-point airflow sensors at locations as required by Building Management Control System.
- C. Controller enclosure
- D. Mixing attenuator.

2.4 PRIMARY AIR DAMPER AND ACTUATOR

- A. The control actuator shall vary the primary air damper in response to the control signal.
1. Damper leakage at shutoff shall not exceed 2.0% of the maximum scheduled schedule design airflow at 3" WG inlet static pressure and be tested in accordance with ASHRAE 130.
 2. Locate the damper inside the unit.
 3. Damper connection to the operating shaft shall be a positive mechanical connection.
 4. Damper shall have bearings at all penetrations of inlet tube and terminal housing. Penetration of damper shaft in terminal lining shall have seal at surface of lining to prevent fiber entrainment through rotation of damper shaft.
 5. Two damper stop pins shall be provided. One pin shall ensure damper cannot rotate beyond full closed position. One pin shall ensure damper cannot rotate beyond full open position.
 6. Inlet tube shall have rolled bead (outward position) prior to penetration point of flow sensor tubing to provide stop point for hard duct and anchor point for flex duct.

2.5 AIR FLOW CONTROL

- A. Provide a flow control device that will limit the maximum CFM of the unit to that scheduled on the drawings.
1. Air quantity shall be factory set.
 2. Thermostat signal shall reset the flow control device to reduce primary air quantity to match load requirements.
 3. Control shall be pressure independent.
 4. Each terminal shall incorporate a flow cross sensor with pick-up points connected

to a center averaging chamber to ensure the following performance:

- a. Controller fidelity shall be +/-5% of set volume with a flex inlet configuration and inlet static variation of 0.5" WG to 6.0" WG.
5. Coordinate flow sensor locations with Building Management and Controls Contractor.
6. Flow sensor tubing shall have gaskets at penetration point of inlet tube.
7. Flow sensor shall be center averaging type. Non-center averaging flow sensors are not acceptable.
8. Flow sensor tubing to be connected with brass barb fittings.
9. Tubing from air flow sensor to DDC controller shall be Tygon tubing (no exceptions)

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Deliver and store products in a clean and dry place. Protect products from the weather, dirt, dust, construction debris and physical damage.
- B. Install each unit in accordance with the manufacturer's printed installation instructions.
- C. Suspend each unit from 1/4" electroplated zinc thread rods secured from structure.
 1. Provide sub-structure where required.
 2. Mount bottom of terminal unit no more than 18" above the finish ceiling height.
 3. Install units so that they are level and plumb.
- D. Install a straight length of rigid ductwork upstream of all boxes. Provide at least 3 primary air inlet diameters of straight ductwork upstream of the primary air inlet connections. Flexible duct connections at boxes are allowed but are not a substitute for the straight run of rigid duct. A maximum of 4' of flexible duct is allowed at each box. All changes in direction shall be made with rigid duct. Seal connection at box, as required to comply with system maximum allowable leakage.
- E. Coordinate the location of each variable air volume unit to ensure proper clearance so that all components are accessible and not blocked by other trades. Provide no less than the code required clearances to electrical components.
- F. Cover and seal the openings of the VAV inlets during construction to prevent the inside from getting dirty. Where VAV units are considered dirty, as determined by the Architect / Engineer / Owner, clean the VAV units with a vacuum machine, and then wipe all surfaces with a cleaning agent, using clean rags.

3.2 MISCELLANEOUS CONTROLS

- A. The following equipment items are to be furnished by Building Management and Control System and installed by Fan Powered Terminal Unit manufacturer:
 1. Automatic temperature control card (DDC).
 2. Damper actuator.
 3. Discharge air temperature sensor
- B. The following equipment items are to be furnished and installed by the Dual Duct Unit manufacturer:
 1. Damper.
 2. Multi-point flow sensors.
 3. Controller enclosure.
 4. Tubing from air flow cross to DDC controller.
 5. Factory provided external taps for air flow readings with corresponding chart/label on box near dampers.
 6. Mixing attenuator.
- C. Coordinate location of controller enclosure, inlet sensors, wiring of terminal equipment controller and transformer required by the Building Management and Control System

contractor.

END OF SECTION

**SECTION 23 3713
AIR DEVICES**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install air distribution devices, including grilles, diffusers, registers, dampers, and extractors.

1.2 RELATED WORK

- A. Division 23 Mechanical.
 - 1. Ductwork.
 - 2. Air Balance.
 - 3. Electrical Requirements for Mechanical Work.

1.3 COOPERATION WITH OTHER TRADES

- A. Coordinate this work with work under Division 26 Electrical, to ensure that intended functions of lighting and air systems are achieved.

1.4 SUBMITTALS

- A. Submit product data for outlets, grilles, registers, control devices, and similar equipment for review prior to placement of purchase order.
- B. Submittal shall include performance sheet for each air device type. Performance sheet shall include NC levels, throw, and total pressure loss at various air flows.

1.5 FINISHES

- A. Paint exposed devices with factory standard prime coat, or factory finish coat, as specified.

PART 2 - PRODUCTS

2.1 DIFFUSERS, GRILLES AND REGISTERS - Refer to Drawing Schedule.

- A. Perforated grilles shall not be used for supply air, return air or exhaust air.
- B. Stamped face, Egg Crate (of any material) or door grilles shall not be used.
- C. Acceptable Grilles and Diffusers:
 - 1. Supply Air Diffusers/Grilles
 - a. Lay-in Square Cone, Steel or Aluminum, 360° pattern
 - b. Lay-in Square Plaque, Steel or Aluminum, 360° pattern
 - c. Surface Mount Square Louver Face, Steel or Aluminum, 360° pattern
 - d. Round Cone, Steel or Aluminum, Steel or Aluminum, 360° pattern
 - e. T-Bar Slot, Steel or Aluminum
 - f. Double Deflection (Sidewall), Steel or Aluminum
 - 2. Return Air Grilles
 - a. Louvered face, Steel or Aluminum, 45° deflection, 3/4" blade spacing
Surface or lay-in type

2.2 ACCEPTABLE MANUFACTURERS

- A. Titus.
- B. Krueger.
- C. Nailor Industries.
- D. Metalaire
- E. Price

2.3 ACCESSORIES

- A. Supply Grille Extractors. Provide supply grilles with an air control device capable of positively regulating the volume of air extracted from the supply duct. Select extractors similar to Titus Model AG25, tight-closing in the minimum position. Include a key-operated or worm-gear adjusting mechanism to facilitate positioning from the grille opening. Where adjustment is not accessible at the grille opening, provide a square control rod equipped with a locking quadrant.
- B. Mounting Frames. Provide each grille or register not equipped with a removable core with a companion, all-purpose mounting frame constructed like grille frame to facilitate installation and removal of the grille or register without marring adjacent mounting surfaces.
 - 1. Furnish frames with 1/2" thick sponge rubber gasket to prevent air leakage.
 - 2. Provide a frame that neatly fits the grille. Mounting frames will not be required for grilles or registers mounted directly on exposed ductwork.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Do not install ceilings adjacent to fixtures until installation of fixtures, air supply assemblies, return-air blank-off strips and flexible duct have been approved. Remove and reinstall any part of the installation found incorrect.

3.2 INSTALLATION

- A. Louvered diffuser outlets mount tight against the ceiling. Fasten outlets to ductwork with sheet metal screws.

END OF SECTION

**SECTION 23 4100
AIR FILTRATION**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install air filters.

1.2 RELATED WORK

- A. Division 23 Mechanical.

1.3 SUBMITTALS

- A. Submit manufacturer's product data sheets and capacity information as specified.
- B. Submit recommended Dirty Filter pressure drop.

PART 2 - PRODUCTS

2.1 MEDIUM EFFICIENCY AIR FILTERS

- A. The filter cells:
 - 1. Pleated media.
 - 2. Disposable type.
 - 3. Contain not less than 4.6 sq. ft. of filtering media per square foot of face area.
 - 4. 18 pleats per linear foot of filter.
 - 5. 2" thick.
- B. Media of reinforced nonwoven cotton fabric treated with adhesive and continuously laminated to a supporting steel wire grid conforming to the configuration of the pleats.
 - 1. Seal the media pack in a water resistant cardboard frame.
- C. Rated average dust spot efficiency of not less than 80%.
 - 1. Average synthetic arrestance in excess of 98% when tested in accordance with the ASHRAE 52-68 test standard.
- D. Filter capable of operating with variable face velocities up to 500 fpm without impairing efficiency.
- E. Initial resistance to air flow:
 - 1. 500 fpm - 0.41" WG.
- F. UL listed with Class II rating.
- G. Air Filter Inc. Astro-Pleat MERV 13 minimum
- H. Provide one spare set for a complete change, in original cartons, for Owner's use during the warranty period.
- I. Standard sizes 16x20x2, 16x25x2, 20x20x2, 20x25x2 only. If 1" filters are only option for equipment, sizes must be standard sizes as listed.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install the filters in accordance with the manufacturer's instructions.

END OF SECTION

**SECTION 23 5720
HEAT EXCHANGER**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install a tube and shell water to water heat exchanger as shown.

1.2 RELATED WORK

- A. Division 23 - Mechanical
 - 1. Condensing Water Piping
 - 2. Valves, Strainers and Vents
 - 3. Gauges, Thermometers and Flow Meters

1.3 REFERENCES

- A. ANSI/ASME - Boilers and Pressure Vessels Code.

1.4 REGULATORY REQUIREMENTS

- A. Conform to Section VIII, Division I of the ANSI/ASME Boilers and Pressure Vessels Code for manufacture of heat exchanger and heat exchanger shells.
 - 1. Design pressure of 150 psi at 240°F for both circuits.

1.5 SUBMITTAL

- A. Submit manufacturer's product data sheets and unit capacity information as specified.
- B. Submit manufacturer's installation, start-up and service instructions.
- C. Submit manufacturer's certificate that heat exchanger meets or exceeds specified requirements.
- D. Submit design data in sufficient detail to verify that heat exchanger meet or exceed specified requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Alfa-Laval.
- B. B & G.

2.2 SHELL AND TUBE HEAT EXCHANGER

- A. Construction.
 - 1. Stainless Steel epoxy coated shell, copper tubes and steel heads.
 - 2. All metal surfaces that are in contact with pool water shall be Cupronickel construction.
 - 3. Verify compatibility of material with swimming pool chemicals and designed to be resistant to corrosion from chlorinated water.
- B. The entire assembly shall be bolted together at the factory and tested in accordance with the ASME code.
 - 1. Provide lifting lugs designed to permit lifting of the assembly at its flooded weight.
- C. The entire assembly shall be epoxy coated to provide protection from pool chemicals present within equipment room.

2.3 INSTRUMENTS AND RELIEF VALVES

- A. Provide in the inlet and outlet of each circuit a thermometer.
 - 1. Mounted in brass well.
 - 2. Range: 30°F to 130°F.

- B. Provide in the outlet of the closed circuit an ASME rated temperature and pressure relief valve with full sized drain to the floor.
- C. Inlet and outlet piping connections to heat exchanger shall be flanged and bolted. Groove connections shall not be provided.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install heat exchanger, piping and accessories in accordance with manufacturer's instructions.
- B. Install to permit removal of tubes with minimum disturbance to installed equipment and piping.
- C. Support the heat exchanger from factory assembled structural supports and floor stand.
- D. Pipe relief valves to the nearest floor drain.
- E. Pipe drain valves to the nearest floor drain.

END OF SECTION

**SECTION 23 7313
AIR HANDLING UNITS**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install air handling units with casing, fans, coils, filters and special items.

1.2 RELATED WORK

- A. Division 23 Mechanical
1. Air Balance
 2. Ductwork
 3. Controls
 4. Electrical Provisions of Mechanical Work
 5. Air Filtration
 6. Heating and Cooling Coils
 7. Other applicable sections

1.3 PERFORMANCE

- A. Unit capacities and characteristics as indicated.
1. Units must be certified in accordance with ARI Standard 430-66.
 2. UL 1995 certification for safety including electric heat.
 3. ARI 430 listed and meet NFPA 90A requirements.

1.4 SHOP DRAWINGS

- A. Indicate assembly, unit dimensions, weight loading required clearances, construction details, field connection details, and electrical characteristics and connection requirements.
- B. Submit fan performance curve for each unit:
1. Plot fan volume against static pressure, horsepower and efficiency.
 2. Show point of rating based on static requirements of the system.
 3. Chart of specific sound power level at each octave band center frequency.
 4. For variable volume units, plot fan volume over entire range.
- C. Submit for review a unit internal static pressure loss calculation.
1. Provide an itemized list of static pressure loss at the scheduled CFM for each unit component including and not limited to:
 - a. Coils
 - b. Dirty filters
 - c. Fan and unit system effect
 - d. Cabinet and cabinet inlet and outlet
 - e. Unit mounted dampers
 2. If a unit mounted outside air pretreatment section without supply fan, "piggyback" is specified:
 - a. Provide an itemized static pressure loss as indicated above.
 - b. Determine losses for unit configuration, i.e. parallel or series.
 - c. Include losses in the primary unit internal static pressure required by configuration.
 3. The air handling unit schedule indicates static pressure external to the unit and does not include any losses associated with the air handling equipment.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, condensate properly tapped, piping connections verified and leak tested, belts aligned and tensioned, all shipping braces have been removed, and fan has been tested under

observation.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Inspect for transportation damage and store in a clean, dry location. Protect from weather and construction traffic.
- B. Manufacturer shall provide quick shipment options to minimize product lead times.

1.7 WARRANTY

- A. The Air Handling Unit manufacturer shall provide a full machine parts and labor warranty for a period of one (1) year from substantial completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Carrier
- B. Daikin
- C. JCI
- D. Temtrol
- E. Thermal
- F. Trane

2.2 MISCELLANEOUS REQUIREMENTS

- A. Provide factory assembled units. Large units may be shipped in sections, at contractor's option, to enable entrance to building, or for oversize shipping reasons only.
- B. Furnish units with sealing and fastening hardware supplied by the manufacturer. Include written instructions needed to complete field assembly of the components.
- C. Provide units designed and constructed so that coils, panels, fan housing and fans can be removed without affecting the structural integrity of the unit.
- D. Unit casing panels shall be double wall construction with solid galvanized exterior and solid galvanized interior. Panels shall have a minimum thermal resistance of R-13. The casing shall not exceed 0.0042 inch deflection per inch of panel span at 1.5 times the design static pressure up to a maximum of +8 inches in all positive pressure sections and -8 inches in all negative pressure sections.
- E. Provide full perimeter base rail channel under units constructed of heavy gauge galvanized steel (minimum 10 gauge) and intermediate cross members to assure unit integrity. Provide minimum size base rail to ensure proper trapping and slope of condensate drain (minimum 6 inch from bottom of drain opening).
- F. Fan assembly shall be provided with 1" deflection internally mounted spring vibration isolation under the fan and motor base on units with coils less than 8 sq. ft. and 2" deflection internally mounted spring vibration isolation under the fan and motor base with coils greater than 8 sq. Ft. Units with coils over 35 sq. ft. shall have spring thrust restraints securing the fan housing to the discharge opening panel on units. Fan motor shall be internally mounted. Provide internal flex connection of fan discharge. Maximum acceptable RPM of fan shall not exceed 1000.
- G. Provide factory installed removable hinged access doors in the following locations:
 - 1. Entering and leaving side of all coils to allow for cleaning of coils on both sides of unit.
 - 2. Each side of filter compartment to allow changing of filters from either side.
 - 3. Each side of motor compartment to allow motor and isolation access.
 - 4. Each side of condensate drain pan to allow for cleaning and inspection.
 - 5. Swing the doors against the casing static pressure.
- H. Provide all coil modules, including heating coil modules, with stainless steel drain pans to facilitate cleaning and maintenance of the coils. Drain pan to extend 10" minimum downstream of cooling coil.

- I. Provide coils with stainless steel casings, end plates, tube supports and top & bottom plates.
- J. Units shall meet ASHRAE III Class 6 Low Leakage Standard. Casing shall have less than a 1% leakage rate at plus or minus 8 inches W.G.

2.3 DRAW THROUGH AIR HANDLING UNITS

- A. Provided with:
 - 1. V-belt drive assembly and motor.
 - 2. Insulated sheet metal cabinet with removable panels for access to the interior.
 - 3. Full hinged double wall doors with two-step safety handles.
- B. Drive assembly:
 - 1. Size for 50% overload.
 - 2. Matched belts.
 - 3. Minimum two belt drive Type "B" only (5/8" wide)
 - 4. Provide adjustable pitch motor pulley for motors.
 - 5. Provide motor and fan pulley of cast iron keyed to the shaft.
- C. Select the motor so that the brake horsepower required to deliver the design air quantity at the system static pressure will not exceed the motor nameplate rating.
 - 1. Totally enclosed, fan cooled, Variable Speed.
 - 2. Minimum 90% nominal efficiency at loads of 70% to 100%.
 - 3. Premium efficiency
 - 4. Cast iron frame and end plate
 - 5. Forged steel lifting eye
 - 6. Oversized conduit box with ground lug
 - 7. Provide with factory installed shaft grounding ring by Aegis on units which utilize a variable frequency drive.
 - 8. Greaseable bearings for motors.
- D. Supply Fans:
 - 1. Double width, double inlet, forward curved blades.
 - 2. Statically and dynamically balanced.
 - 3. Tested after being installed in the fan sections.
 - 4. Selected for the design air quantities and pressure of the system.
 - 5. Mounted on a common shaft if multiple wheels.
 - 6. Minimum of Class II fans.
- E. Select fan to operate at or near its maximum efficiency point when handling the required air quantity and static pressure.
- F. Stainless steel condensate pan with positive slope in all directions to outlet. Line the condensate drain pan with minimum 2" waterproof insulation.
- G. Fan bearings:
 - 1. Greaseable bearings
 - 2. Remote grease fittings grouped on the motor access side of the unit.
 - 3. Self-aligning.
 - 4. Select for an average life of 200,000 hours.
- H. Insulation, vapor barriers, facings and adhesives shall have:
 - 1. Flame spread not higher than 25.
 - 2. Smoke developed rating not higher than 50.
- I. Double wall casing construction. Construct interior casing panels with 3 lb. minimum density insulation for acoustical and condensation control.
 - 1. Condensation on the exterior of the air handling units is not acceptable.
- J. Filter section:
 - 1. Constructed with substantial hinges.
 - 2. Neoprene gasketing.
 - 3. Permanent quick release latching devices.

4. Arranged to accommodate 2" thick filters as specified.
 5. Filter rack shall be factory manufactured to accommodate the filter sizes listed below. Field alterations to filter section is unacceptable.
 6. Low velocity angled filter section unless otherwise specified.
 7. 16x20x2, 16x25x2, 20x20x2, 20x25x2 only.
- K. Cooling coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.
- L. Heating coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.
1. Location as indicated.
- M. Factory dynamic fan balancing shall be conducted from 16Hz to 60Hz to identify and eliminate critical speeds to ensure stable operation through the entire operating range of the fan and drive assembly. Field fan balancing is not acceptable. Forward factory balancing test report to Engineer upon request.

2.4 BLOW THROUGH VARIABLE AIR VOLUME AIR HANDLING UNIT – DOUBLE DUCT

- A. Provided with:
1. V-belt drive assembly and motor.
 2. Insulated sheet metal cabinet with removable panels for access to the interior.
 3. Full hinged double wall doors with two-step safety handles.
- B. Drive assembly:
1. Sized for 50% overload.
 2. Matched belts.
 3. Minimum two belt drive Type "B" only (5/8" wide)
 4. Provide adjustable pitch motor pulley for motors.
 5. Construct pulley of cast iron; keyed to the shaft.
- C. Motor selected so that the brake horsepower required to deliver the design air quantity at the system static pressure will not exceed the motor nameplate rating.
1. Totally enclosed, fan cooled, Variable Speed.
 2. Minimum 90% nominal efficiency at loads of 70% - 100%.
 3. Premium efficiency
 4. Cast iron frame and end plate
 5. Forge steel lifting eye
 6. Oversized conduit box with ground lug
 7. Provide with factory installed shaft grounding ring by Aegis.
 8. Greaseable bearings for motors.
- D. Supply Fans shall be:
1. Double width, double inlet, non-overloading, air-foil blade centrifugal fan, or forward curve fan as required.
 2. Statically and dynamically balanced.
 3. Tested after being installed in the fan sections.
 4. Selected for the design air quantities and pressure of the system.
 5. Mounted on a common shaft if multiple wheels.
 6. Minimum of Class II fans.
- E. Select fan to operate at or near its maximum efficiency point when handling the required air quantity and static pressure.
- F. Stainless steel condensate pan with positive slope in all directions to outlet. Insulate the condensate drain pan with a minimum of 1-1/2" waterproof insulation.
- G. Fan Bearings:
1. Greaseable bearings
 2. Remote grease fittings grouped on the motor access side of the unit.
 3. Self-aligning.

- 4. Select for an average life of 200,000 hours.
- H. Insulation, vapor barriers, facings and adhesives shall have:
 - 1. Flame spread not higher than 25.
 - 2. Smoke developed rating not higher than 50.
 - 3. 3 lb. density insulation on interior casing panels
- 1. Condensation on the exterior of the air handling units is not acceptable.
- I. Filter section:
 - 1. Constructed with substantial hinges.
 - 2. Neoprene gasketing.
 - 3. Permanent quick release latching devices.
 - 4. Arranged to accommodate 2" thick filters as specified.
 - 5. Filter rack shall be factory manufactured to accommodate the filter sizes listed below. Field alterations to filter section is unacceptable.
 - 6. Low velocity angled filter section unless otherwise specified.
 - 7. 16x20x2, 16x25x2, 20x20x2, 20x25x2 only.
- J. Cooling coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.
- K. Heating coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.
- L. Provide a factory installed equalizing grid in the hot deck where heating coils are not installed.
- M. Factory dynamic fan balancing shall be conducted from 16Hz to 60Hz to identify and eliminate critical speeds to ensure stable operation through the entire operating range of the fan and drive assembly. Field fan balancing is not acceptable. Forward factory balancing test report to Engineer upon request.
- N. Design the entrance to the hot and cold decks and baffle to preclude wiping action of the air stream.
- O. Equipment capacities as indicated.

2.5 DRAW THROUGH AIR HANDLING UNITS – VARIABLE AIR VOLUME

- A. Provided with:
 - 1. Non-Overloading direct drive plenum fans. Provide minimum number of fans as indicated on drawings.
 - 2. Insulated sheet metal cabinet with removable panels for access to the interior.
 - 3. Hinged double wall doors with two-step safety handles.
- B. Drive assembly:
 - 1. Sized for 50% overload.
- C. Motors and Control:
 - 1. Totally enclosed, fan cooled, Variable speed, 1750 rpm.
 - 2. Maximum operating point of 70 Hz.
 - 3. Minimum 90% nominal efficiency at loads of 70%-100%.
 - 4. Premium efficiency inverter duty
 - 5. NEMA B design, with Class B insulation, capable to operate continuously at 104 deg F without tripping overloads.
 - 6. +/- 10% voltage utilization range to protect against voltage variation.
 - 5. Cast iron frame and end plate
 - 6. Forged steel lifting eye
 - 7. Oversized conduit box with ground lug
 - 8. Provide with factory installed shaft grounding rings by Aegis
 - 9. Motor selected so that the brake horsepower required to deliver the design air quantity at the system static pressure will not exceed the motor nameplate rating.
- D. Supply Fans:

1. Single width, single inlet, backward curved welded aluminum plenum fan.
 2. Statically and dynamically balanced to a BV-3 per AMCA 204 test standard.
 3. Tested after being installed in the fan sections.
 4. Selected for the design air quantities and pressure of the system.
 5. Mounted on a common shaft if multiple wheels.
 6. The fan shall be rated in accordance with AMCA 210 for performance and AMCA 260 for sound.
 7. Minimum of Class II fan.
- E. Fans selected with isolation shall be internally isolated with spring isolators. A flexible connection shall be installed between fan and unit casing to ensure complete isolation. Flexible connection shall comply with NFPA 90A and UL 181 requirements. If fans and motors are not internally isolated, then the entire unit shall be externally isolated from the building, including supply and return duct work, piping, and electrical connections. External isolation shall be furnished by the installing contractor to avoid transmission of noise and vibration through the ductwork and building structure.
- F. Each direct drive fan in a multiple-fan array shall be provided with integral back flow prevention: a backdraft damper that prohibits recirculation of air in the event a fan or multiple fans become disabled. Dampers are tested and rated based on AMCA Standard 500. Dampers to be heavy duty type capable of a maximum back pressure that exceeds the design total static pressure with minimal leakage. The dampers should have a minimal total effect on airflow performance; both pressure drop when open and system effect on the fan. The damper blades and frame shall be extruded aluminum with blade edge seals locked into the blade edge. Adhesive type seals are unacceptable. AHU manufacturer responsible for providing proper spacing upstream of dampers to ensure full, uniform airflow through upstream components. For units where the damper(s) are supplied at the jobsite, the installing contractor shall contract a certified TAB contractor to verify uniform airflow thru upstream components.
- G. Select fan to operate at or near its maximum efficiency point when handling the required air quantity and static pressure.
- H. Stainless steel condensate pan with positive slope in all directions to outlet. Line the condensate drain pan with minimum 1-1/2" waterproof insulation.
- I. Insulation, vapor barriers, facings and adhesives shall have:
1. Flame spread not higher than 25.
 2. Smoke developed rating not higher than 50.
- J. Double wall casing construction. Construct interior casing panels with 3 lb. minimum density insulation for acoustical and condensation control.
1. Condensation on the exterior of the air handling units is not acceptable.
- K. Filter section:
1. Constructed with substantial hinges.
 2. Neoprene gasketing.
 3. Permanent quick release latching devices.
 4. Arranged to accommodate 2" thick filters as specified.
 5. Filter rack shall be factory manufactured to accommodate the filter sizes listed below. Field alterations to filter section is unacceptable.
 6. Low velocity angled filter section unless otherwise specified.
 7. 16x20x2, 16x25x2, 20x20x2, 20x25x2 only.
- L. Cooling coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.
- M. Heating coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.
- N. Provide units with factory fabricated mixing box section that include an additional 2" thick metal perforated inner liner which utilizes fiberglass insulation. Liner shall be installed on

- all walls and top surface.
- O. Provide each fan section with an additional 2" thick perforated metal inner liner which utilizes fiberglass insulation. Liner shall be installed on all walls and top surface.
- P. Factory dynamic fan balancing shall be conducted from 16Hz to 60Hz to identify and eliminate critical speeds to ensure stable operation through the entire operating range of the fan and drive assembly. Field fan balancing is not acceptable. Forward factory balancing test report to Engineer upon request.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install air handling units according to manufacturer's instructions.
- B. Provide additional drive packages as required by the Testing and Balancing firm.
- C. Air leaks detectable by sound or touch are to be corrected.
- D. Air handling units are to be properly supported to prevent flexing, bending or distorting base rails.
- E. All coils and drain pans are to be cleaned prior to substantial completion if units are used during construction.
- F. Clean all air handling units and return to original manufacturer's condition prior to substantial completion. Vacuum clean all debris from inside air handling equipment.
- G. Install piping to unit with full size 6 inch long dirt leg with 1/2" valve at bottom for cleaning.
- H. Provide for positive gravity drainage of coil condensate. Pipe full size of unit connection.
- I. Adjust fan drives as required to obtain scheduled capacities as directed by the Test and Balance Firm to include sheave and belt replacement.
- J. Align belts to eliminate wear and vibration of belts.
- K. Verify correct drainage of condensate from condensate pan.
- L. Verify correct rotation of fan and wiring of motor.
- M. Lubricate all greaseable ball bearings with manufacturer's suggested lubricant.
- N. Replace filters as required if units are used during construction.
- O. Provide piping installation so that after piping is completed and insulated there is full access to service unit and remove fan housing. Piping to coils shall not block fan section access or cause damage to piping insulation during access.
- P. AHU motors must be wired with Kernay connections inside motor terminal boxes. No wire nuts. Kernay connections must be wrapped with rubber and electrical tape for insulation.

3.2 IDENTIFICATION

- A. Furnish each unit with a durable, deep etched, .025" thick, factory installed aluminum identification plate, permanently mounted with the following information:
 - 1. Unit identification as indicated on Contract Drawings.
 - 2. Serial Number.
 - 3. Model Number.
 - 4. Capacity (CFM) and static pressure.
 - 5. Motor HP.
 - 6. Unit power supply: Volts / PH / Amps.
 - 7. Supply Fan Type.
 - 8. Coil GPM and pressure drop.
 - 9. Sales Order #.
 - 10. Date unit manufactured.

END OF SECTION

**SECTION 23 8216
HEATING AND COOLING COILS**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install heating and cooling coils.

1.2 SUBMITTALS

- A. Submit manufacturer's product data sheets and unit capacity information as specified.
- B. Submit manufacturer's Installation, Start-Up and Service Instructions.
- C. Submit internal wiring diagram.
 - 1. Electrical interlocks. *

1.3 RELATED WORK

- A. Division 23 Mechanical.
 - 1. Air Handling Units.
 - 2. Fan Coil Units.
 - 3. Weatherproof Roof Mounted Air Handling Units.
 - 4. Ductwork.
 - 5. Terminal Boxes.

PART 2 - PRODUCTS

2.1 HOT WATER COILS

- A. Hot water coils:
 - 1. Constructed of copper tubes and aluminum fins.
 - 2. Designed and circuited for hot water.
 - a. Maximum temperature 200°F.
- B. Where coils are installed in fan powered VAV boxes, unit heaters and other locations the maximum approved fin spacing is 8 fins per inch.
- C. Non-trapping circuit design:
 - 1. Working pressure 200 psi
 - 2. Tappings for drain and air vent
- D. Provide a Peterson Pete's Plug with retainer strap on the inlet and outlet of each coil.
 - 1. Positioned to permit accurate pressure readings.
- E. Coils shall be constructed in casings as required for installation.
- F. Heating coils installed within ductwork or on the leaving side of a terminal unit shall be installed with a transition ductwork section to match the full face area of the heating coil. Provide an access door on both the entering and leaving sides of the duct mounted coil.

2.2 CHILLED WATER COILS

- A. Chilled water coils:
 - 1. Constructed of copper tubes and aluminum fins
 - 2. Designed and circuited for chilled water
 - 3. Minimum of six rows
- B. Non-trapping circuit design:
 - 1. Working pressure 200 psi.
 - 2. Tappings for drain and air vent.
- C. Provide a Peterson Pete's Plug with retainer strap on the inlet and outlet of each coil. Position to permit accurate pressure readings.
- D. Coils shall be constructed in casings as required for installation.
- E. Where coils are stacked, provide intermediate drain pans with drop tubes to drain condensate to the main drain pan without flooding the lower coil.

2.3 DIRECT EXPANSION COOLING COILS

- A. DX cooling coils:
 - 1. Constructed of copper tubes and aluminum fins.
 - 2. Designed and circuited for use with direct expansion refrigeration.
- B. Cooling coil face velocity:
 - 1. Not of magnitude to cause moisture to be carried off the coil.
 - 2. Maximum velocity as scheduled.
- C. Circuit cooling coil with interlaced tubes so the entire face is active under all modes of unloading. Refer to the schedule on the drawings.
- D. Coils shall be constructed in casings as required for installation.
- E. Where coils are stacked, provide intermediate drain pans with drop tubes to drain condensate to the main drain pan without flooding the lower coil.

2.4 ELECTRIC HEATERS

- A. Capacity shall be as scheduled on the drawings. Heater shall have 80% nickel, 20% chromium, open resistance coils insulated by floating ceramic bushings, and be supported in an aluminum steel frame.
- B. Ceramic bushings shall be recessed into embossed openings and staked into supporting brackets spaced 3-1/2" maximum center to center.
- C. Coil shall be machine-crimped into threaded terminals and insulated with phenolic bushings. All terminal hardware shall be stainless steel.
- D. Heater shall be listed by the Underwriters Laboratories for zero clearance to combustible surfaces and for use with central air conditioners.
- E. For primary protection, furnish a disk-type automatic reset thermal cutout for pilot duty only.
- F. For secondary protection, load-carrying manual reset thermal cutouts shall be wired in series with each heater circuit. Cutouts shall be rated at 480 volts minimum.
- G. Voltage, phase and number of heating stages shall be furnished in accordance with duct heater schedule. Three-phase heaters shall have single-phase circuits for operation from a 3-phase, 4-wire power source. Circuits shall be rated at 48 amperes maximum. Furnish one set of line terminals to feed all circuits. Heater shall be tested dielectrically at 2000 volts before shipment. Field-installed conductors feeding the heater shall be sized for 125% of the connected load.
- H. Built-in components shall be factory wired to terminal blocks for field connection. All internal wiring shall be insulated for 105°C. Built-in magnetic contactors shall disconnect all ungrounded conductors to each circuit. Furnish heaters with an air flow switch that will not allow heaters to energize without proof of air flow. Built-in transformer shall be dry industrial type, sized to carry full contactor holding coil load. Primary windings shall be fused at the factory. Built-in fuses shall be factory wired to each circuit to protect all underground conductors. Type NON or NOS fuses to be factory installed in phenolic fuse blocks. Built-in disconnect switch to be snap action, industrial type. Provide a door interlock mechanism to prevent hinged terminal box cover from being opened when the switch is on. Switch shall be unfused.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install the duct heaters in accordance with the manufacturer's Installation, Start-Up and Service Instructions.

END OF SECTION

**SECTION 23 8218
DUCTLESS MINI SPLIT DX UNITS**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install mini split system. Complete with a slim silhouette, compact, high wall fan coil section with a wired wall mounted thermostat and a slim silhouette horizontal discharge outdoor condensing unit. Unit shall be provided with inverter driven compressor, pre-charged with R410A or R32 refrigerant. air-cooled condensing units complete with casing, compressor, condenser coil, condenser fan and controls required for a split air conditioning system.

1.2 RELATED WORK

- A. Refrigerant Piping.
- B. Electrical Provisions of Mechanical Work.

1.3 PERFORMANCE

- A. Provide performance as scheduled on drawings, and head pressure control to enable unit to operate in temperatures as low as 20 degrees F. ambient.

1.4 QUALITY ASSURANCE

- A. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL) and bear the ETL label.
- B. All wiring shall be in accordance with the National Electrical Code (N.E.C.).
- C. The units shall be rated in accordance with Air-conditioning, Heating, and Refrigeration Institute's (AHRI) Standard 210 and bear the AHRI Certification label.
- D. The units shall be manufactured in a facility registered to ISO 9001 Quality assurance Standards and ISO 14001 which are set of standards applying to sustainability and environmental protection set by the International Standard Organization (ISO).
- E. A pressure charge of R410A or R32 refrigerant sufficient for up to twenty-five (25) feet of refrigerant tubing shall be provided in the outdoor condensing unit.
- F. A dry air holding charge shall be provided in the indoor section.

1.5 WARRANTY

- A. Unit shall have a manufacturer's parts and defects warranty for a period five (5) years from the date of the original installation. The compressor shall have a warranty of seven (7) years from date of installation. Warranties shall start at the date of substantial completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Daikin
- B. Trane - Mitsubishi
- C. LG

2.2 INDOOR UNIT GENERAL

- A. The indoor shall be factory assembled, wired and run tested. Contained within the unit cabinet shall be all factory wiring, internal piping, electronic control circuit board and fan with fan motor.
- B. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and auto restart after power interruption function, an emergency operation function and a test run switch.
- C. Indoor unit and refrigerant pipes shall be charged with dry air before shipment from the

factory. All refrigerant piping must be insulated.

2.3 CABINET

- A. The casing shall have a smooth front, top return, in a white finish.
- B. Multi directional drain and refrigerant piping offering four (4) directions for refrigerant piping and two (2) directions for draining shall be standard.
- C. There shall be a separate installation plate which secures the unit firmly to the wall. Secure mounting of plate and all mounting hardware shall be furnished by and be the responsibility of the installer.

2.4 FAN

- A. The indoor unit fan shall be an assembly with a line-flow fan direct driven by a single motor mounted in rubber motor mount.
- B. The fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings.
- C. Manual adjustable vertical guide vanes shall be provided with the ability to change the airflow from side to side (left to right).
- D. An integral, motorized, horizontal air sweep flow louver shall provide an automatic change in airflow by directing the air up and down to provide for uniform air distribution.
- E. The indoor unit fan motor shall operate in four (4) selectable speeds, Powerful, High, Medium, and Low.

2.5 FILTER

- A. Return air shall be filtered by means of easily removed, washable, Catechin air filter and an anti-allergy enzyme filter – blue bellows type.

2.6 COIL

- A. The indoor unit (evaporator) coil shall be of nonferrous construction with smooth, pre-coated aluminum fins on copper tubing.
- B. Tubing shall have inner grooves for high efficiency heat exchange.
- C. All tube joints shall be brazed with PhosCopper or silver alloy.
- D. The coil shall be pressure tested at the factory.
- E. A sloped condensate pan and drain shall be provided under the coil. Drain connections shall be provided at each end of the drain pan.

2.7 ELECTRICAL

- A. Power for the indoor unit shall be supplied from the outdoor unit.
- B. Power supply shall be as indicated on the drawings.
- C. The unit shall be equipped with a micro-processor control system directing indoor and outdoor unit coordinated operation.
- D. The indoor unit shall not have any supplemental electrical heat elements.

2.8 CONTROL

- A. This system shall have a wired wall mounted thermostat/controller to perform input functions necessary to operate the system. The controller shall consist of a Power On / Off switch, Mode Selector, Temperature Setting, Timer Control, Fan Speed Select and Auto Vane Selector.
- B. Temperature changes shall be by 1°F increments with a range of 65°F to 87°F.
- C. There shall be a 24 hour On / Off timer.
- D. The microprocessor located in the indoor unit shall have the capability of sensing return air temperature and indoor coil temperature, receiving and processing commands from the space controller, providing emergency operation and controlling the outdoor unit.
- E. The control voltage between the indoor unit and the outdoor unit shall be 115 volts, AC.

- F. The system shall be capable of automatic restart when power is restored after power interruption.
- G. The control system shall control the operation of the air sweep louvers, as well as provide on / off and system / mode function switching.

2.9 OUTDOOR UNIT GENERAL

- A. The outdoor unit is designed specifically for use with the indoor units. The outdoor unit shall be completely factory assembled, internally piped and wired. Each unit shall be run tested at the factory.
- B. When refrigerant lines are exposed on exterior of building provide "LINE-HIDE" line set cover system.
 - 1. Material, Weather resistant, UV stabilized, ASA/PVC/ABS/Poly/PE
 - 2. Assembly Screws, stainless steel.

2.10 UNIT CABINET

- A. The casing shall be fabricated from zinc coated steel, bonderized with an electrostatically applied, thermally bonded, acrylic or polyester powder coating for corrosion protection.
- B. Case and mounting feet shall be as follows:
 - 1. The base shall be of Aluminum-Zinc-Magnesium alloy coated steel, with welded mounting feet.
- C. Cabinet mounting and construction shall be sufficient to withstand 155 MPH wind speed conditions for use in Hurricane condition areas. Mounting, base support, and other installation to meet Hurricane Code Conditions shall be by others.

2.11 FAN

- A. The unit shall be furnished with a directive drive propeller type fan, statically and dynamically balanced for smooth and quiet operation.
- B. The fan motor shall have inherent protection, be equipped with permanently lubricated bearings. The fan motor shall be mounted and isolated for quiet operation.
- C. The fan shall be provided with a raised guard to prevent contact with moving parts.
- D. The outdoor unit shall have horizontal discharge airflow.

2.12 COMPRESSOR

- A. The compressor shall be a high performance, inverter driven rotary type.
- B. Compressor shall be mounted using rubber isolating bushings to avoid the transmission of vibration.
- C. Compressor shall be protected by an automatic over current relay and a thermal overload switch.

2.13 OPERATION

- A. The outdoor unit shall have an accumulator.
- B. The outdoor unit must have the ability to operate with a maximum height difference of 35 feet between indoor and outdoor units.
- C. The unit shall have a maximum refrigerant tubing length of 65 feet between indoor and outdoor units without the need for line size changes, traps or additional oil. All refrigerant lines must be insulated.
- D. The unit shall be pre-charged for a maximum of 25 feet of refrigerant tubing.

2.14 ELECTRICAL

- A. Power supply shall be as indicated on the drawings.
- B. The outdoor unit shall be controlled by the microprocessor located in the indoor unit. The control voltage between the indoor unit and the outdoor unit shall be 115 volts, AC.

2.15 WALL BRACKET AND ROOF BRACKET

- A. As indicated on the drawings, provide each unit 3 tons and below with a stainless steel mini-split condenser bracket.
- B. Unit shall be constructed for a maximum weight of 300 lbs.
- C. Unit shall be manufactured by Rectorseal model #WBB-300SS, Diveritech model #QSWB4000SS or approved equal.

2.16 CONDENSATE PUMPS

- A. A condensate pump shall only be provided as a means of condensate disposal when a gravity drain is not available.
- B. Provide a Little Giant Model #554642 VCMA-20ULS-C-PRO-20.
- C. Unit shall be provided with anti-sweat sleeve, tank bracket and overflow detection switch.
- D. Condensate pump shall be wall mounted. Mount pump under wall cassette.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount condensing units on 4" foundation pads and pipe as shown on Drawings or as recommended by the equipment manufacturer. Install refrigerant filter dryer and sight indicating glass.
- B. Install units on vibration isolation pads.
- C. Ensure unit provided will meet the refrigerant and line lengths required by the installation as indicated on the drawings.
- D. Provide convenience water and electrical within 50 feet of new condensing unit.

3.2 CONTROL WIRING

- A. Furnish and install control wiring as required. Install control wiring in conduit.

3.3 DELIVERY, STORAGE AND HANDLING

- A. Unit shall be stored and handled according to the manufacturer's recommendations.
- B. The wired controller shall be shipped inside the carton with the indoor unit and able to withstand 105°F storage temperatures and 95% relative humidity without adverse effect.

3.4 START-UP

- A. Follow the manufacturer's start-up procedures.
- B. Provide flexible elastomeric rubber closed cell insulation to prevent condensation from occurring on suction piping. After completion of successful start-up, installing contractor shall seal all openings in insulation and apply a protective aluminum sheetmetal jacket over insulation exposed on exterior of building.

END OF SECTION

**SECTION 26 0105
ELECTRICAL OPERATING AND MAINTENANCE MANUALS**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Compile electrical product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare electrical operating and maintenance data as specified in this Section and as referenced in other sections of specifications.
- B. Instruct Owner's personnel in operation and maintenance of equipment and systems.
- C. Submit 3 copies of complete manual in final form.

1.2 ELECTRICAL OPERATING AND MAINTENANCE MANUAL SUBMITTAL SCHEDULE

- A. Thirty (30) days after receipt of reviewed submittals bearing the Architect / Engineer's stamp of acceptance (including re-submittals), submit for review 1 copy of the first draft of the Electrical Operating and Maintenance Manual. This copy shall contain as a minimum:
 - 1. Table of Contents for each element
 - 2. Contractor information
 - 3. All shop drawings, coordination drawings and product data, bearing the Architect / Engineer's stamp of acceptance.
 - 4. All parts and maintenance manuals for items of equipment
 - 5. Warranties (without starting dates)
 - 6. Certifications that have been completed; submit forms and outlines of certifications that have not been completed
 - 7. Operating and maintenance procedures.
 - 8. Form of Owner's Training Program Syllabus (including times and dates)
 - 9. Control operations / equipment wiring diagrams
 - 10. Coordination Drawings
 - 11. Schedule of Lamps, Light Engines
 - 12. Schedule of Ballasts and Drivers
 - 13. Schedule of Fuses
 - 14. Other required operating and maintenance information that are complete.
- B. Copy will be returned to the Contractor within 15 days with comments for corrections.
- C. Submit the completed manuals in final electronic form to the Architect / Engineer.
 - 1. Prior to substantial completion for Owner's use after the Owner accepts facility maintenance.
 - 2. Include all specified data, test reports, drawings, dated warranties, certificates, along with other materials and information.
- D. The Architect / Engineer shall review the manuals for completeness within 15 days.
- E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.
- F. Complete electronic manuals shall be delivered to the Owner prior to substantial completion.

PART 2 - PRODUCTS

2.1 BINDERS

- A. Commercial quality black, 3-ring binders with clear, durable, cleanable plastic covers.
- B. Minimum ring size: 1"; Maximum ring size: 3".
- C. When multiple binders are used, correlate the data into related groupings.
- D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 ELECTRICAL OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals:

1. Prepare data in form of an instructional manual for use by Owner's personnel.
 2. Format:
 - a. Size: 8-1/2" x 11"
 - b. Text: Manufacturer's printed data or neatly typewritten.
 3. Drawings:
 - a. Provide reinforced punched binder tab and bind in text.
 - b. Fold larger drawings to size of text pages.
 4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
 5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
 - a. Title of Project
 - b. Identity of separate structures as applicable
 - c. Identity of general subject matter covered in the manual.
 6. Binder as specified
- B. Content of Manual:
1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
 - a. Contractor, name of responsible principal, address and telephone number
 - b. A list of each product required to be included, indexed to content of the volume.
 - c. List with each product, name, address and telephone number of:
 - 1) Subcontractor or installer
 - 2) Maintenance contractor as appropriate
 - 3) Identify area of responsibility of each.
 - 4) Local source of supply for parts and replacement
 - d. Identify each product-by-product name and other identifying symbols as set forth in Contract Documents.
 2. Product Data:
 - a. Include those sheets pertinent to the specific product.
 - b. Annotate each sheet to:
 - 1) Identify specific product or part installed.
 - 2) Identify data applicable to installation.
 - 3) Delete references to inapplicable information.
 3. Drawings:
 - a. Supplement product data with drawings as necessary to illustrate:
 - 1) Relations of component parts of equipment and systems
 - 2) Control and flow diagrams
 - b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
 - c. Do not use Project Record Documents as maintenance drawings.
 4. Written text as required to supplement product data for the particular installation:
 - a. Organize in consistent format under separate headings for different procedures.
 - b. Provide logical sequence of instructions for each procedure.
 5. Copy of each warranty, bond and service contract issued
 - a. Provide information sheet for Owner's personnel, giving:
 - 1) Proper procedures in event of failure
 - 2) Instances that might affect validity of warranties or bonds
 6. Shop drawings, coordination drawings and product data as specified.
- C. Sections for Equipment and Systems
1. Content for each unit of equipment and system as appropriate:
 - a. Description of unit and component parts:
 - 1) Function, normal operating characteristics, and limiting
-

- conditions.
 - 2) Performance curves, engineering data and tests.
 - 3) Complete nomenclature and commercial number of replaceable parts.
 - b. Operating procedures:
 - 1) Start up, break-in, routine / normal operating instructions
 - 2) Regulation, control, stopping, shut down and emergency instructions
 - 3) Summer and winter operating instructions
 - 4) Special operating instructions
 - c. Maintenance procedures:
 - 1) Routine operations
 - 2) Guide to trouble-shooting
 - 3) Disassembly, repair and reassembly
 - 4) Alignment, adjusting and checking
 - 5) Routine service based on operating hours
 - d. Servicing and lubrication schedule
 - 1) List of lubricants required
 - e. Manufacturer's printed operating and maintenance instructions.
 - f. Copies of typed circuit directories of panel board to reflect actual room graphics numbers and room names (not architectural room numbers from the drawings).
 - 1) Electrical
 - 2) Controls
 - 3) Communications
 - g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
 - 1) Predicted life of part subject to wear
 - 2) Items recommended to be stocked as spare parts
 - h. Schedule of fuses
 - i. Complete equipment field accessible internal wiring diagrams
 - j. Schedule of lamps
 - k. Schedule of ballasts
 - l. Each Contractor's coordination drawings
 - m. List of original manufacturer's spare parts and recommended quantities to be maintained in storage
 - n. Other data as required under pertinent sections of the specifications
- 2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
 - 3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications
 - 4. Provide complete information for products specified in Division 26.
 - 5. Provide certificates of compliance as specified in each related section.
 - 6. Provide start up reports as specified in each related section.
 - 7. Provide signed receipts for spare parts and material.
 - 8. Provide training report and certificates.

END OF SECTION

**SECTION 26 0500
ELECTRICAL GENERAL PROVISIONS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions, and Supplementary Conditions, applicable provisions of Division 1 General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 26 Electrical.
- B. Applicable provisions of this section apply to all sections of Division 26, Electrical.

1.2 CODE REQUIREMENTS AND FEES

- A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.
- B. Electrical work shall comply with applicable inspection services:
 - 1. Underwriters Laboratories
 - 2. National Fire Protection Association
 - 3. State Health Department
 - 4. Local Municipal Building Inspection Department adopted codes with amendments
 - 5. National Electrical Code with local amendments
 - 6. State Regulatory Agencies
 - 7. Where the project is located outside a municipal jurisdiction, and has no municipal inspection services, the National Electrical Code with amendments of the municipality with extraterritorial jurisdiction shall govern.
 - 8. Where the project is located outside any municipal jurisdiction, including extraterritorial jurisdictions, the National Electrical Code with local adopted amendments of the largest municipality located in the same county or parish shall govern.
 - 9. International Energy Conservation Code
 - 10. National Electrical Safety Code
- C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.
- D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.
- E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

- A. An approved contractor for the work under this division shall be:
 - 1. A specialist in this field and have the personnel, experience, training, and skill, and the organization to provide a practical working system.
 - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that has served their Owners satisfactorily for not less than 3 years.

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

- A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, APWA, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date proposals are received. Referenced specifications and standards are minimum requirements for all equipment, material and work. In instances where specified capacities, size or other features of equipment, devices or materials exceed these minimums, meet specified capacities.
- B. Use electrical materials and equipment that is constructed and tested in accordance with

- the standards of NEMA, ANSI, ASTM, or other recognized commercial standard. If materials and equipment is labeled, listed, or recognized by any Nationally-Recognized Testing Laboratory (NRTL) acceptable to the Occupational Safety and Health Administration (OSHA), then provide NRTL-labeled, listed, or recognized material and equipment. Acceptable NRTLs include but are not limited to:
1. Underwriters Laboratories, Inc. (UL)
 2. Factory Mutual Research Corp. (FMRC) (also referred to as “Factory Mutual Global,” or “FM Global”)
 3. Intertek Testing Services NA, Inc. (ITSNA, formerly ETL)
 4. Canadian Standards Association (CSA)
 5. A complete listing of acceptable NRTLs is published on the OSHA website at <http://www.osha.gov/dts/otpca/nrtl/>.
- C. Where material and equipment is not labeled, listed, or recognized by any NRTL, provide a manufacturer’s Certificate of Compliance indicating complete compliance of each item with applicable standards of NEMA, ANSI, ASTM, or other recognized commercial standard.
- D. Do not install or use electrical material or equipment for any use other than that for which it was designed, labeled, listed, or identified unless formally approved for such use by the Owner’s AHJ. This *National Electrical Code*® requirement is re-stated for emphasis.
- E. Codes and Standards applicable to this Division:
1. ANSI – American National Standards Institute
 - a. ANSI Z535.1, Safety Colors
 - b. ANSI Z535.2, Environmental and Facility Safety Signs
 - c. ANSI Z535.3, Criteria for Safety Symbols
 - d. ANSI Z535.4, Product Safety Signs and Labels
 2. ASHRAE – American Society of Heating, Refrigeration, and Air Conditioning Engineers:
 - a. ASHRAE Standard 90.1, *Energy Standards for Buildings Except for Low Rise Residential Buildings [ANSI, IESNA]*
 3. ASTM – American Society for Testing and Materials
 4. CBM – Certified Ballast Manufacturers
 5. ICC – International Code Council
 - a. International Building Code® (IBC)
 - b. International Existing Building Code® (IEBC)
 6. ICEA – Insulated Cable Engineers Association
 - a. ICEA S-93-639, *Shielded Power Cables 5-46kV* (NEMA WC-74)
 7. IEEE® - Institute of Electronics and Electrical Engineers
 - a. IEEE C2™, *National Electrical Safety Code* (NESC) [ANSI]
 - b. IEEE Std 141™, *Recommended Practice for Electric Power Distribution for Industrial Plants* (“Red Book”)
 - c. IEEE Std 143™, *Recommended Practice for Grounding of Industrial and Commercial Power Systems* (“Green Book”)
 - d. IEEE Std 241™, *Recommended Practice for Electric Power Systems in Commercial Buildings* (“Gray Book”)
 - e. IEEE Std 242™, *Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems* (“Buff Book”)
 - f. IEEE Std 315™, *Graphic Symbols for Electrical and Electronics Diagrams*
 - g. IEEE Std 399™, *Recommended Practice for Power Systems Analysis* (“Brown Book”)
 - h. IEEE Std 446™, *Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications* (“Orange Book”)
 - i. IEE Std 493™, *Recommended Practice for the Design of Reliable*

- j. *Industrial and Commercial Power Systems (“Gold Book”)*
- j. IEEE Std 519™, *Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems*
- k. IEEE Std 739™, *Recommended Practice for Energy Management in Industrial and Commercial Facilities (“Bronze Book”)*
- l. IEEE Std 902™, *Guide for Maintenance, Operation, and Safety of Industrial and Commercial Power Systems (“Yellow Book”)*
- m. IEEE Std 1015™, *Recommended Practice Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems (“Blue Book”)*
- n. IEEE Std 1100™, *Recommended Practice for Powering and Grounding Electronic Equipment (“Emerald Book”)*
- o. IEEE Std 1584™, *Guide for Performing Arc-Flash Hazard Calculations*
- 8. IESNA – Illuminating Engineering Society of North America
 - a. IESNA *Lighting Handbook*, Ninth Edition
 - b. IESNA RP-1, *American National Standard Practice for Office Lighting*
 - c. IESNA RP-7, *American National Standard Practice for Lighting Industrial Facilities*
- 9. NECA – National Electrical Contractors Association:
 - a. NECA 1, *Good Workmanship in Electrical Construction* [ANSI]
 - b. NECA 90, *Recommended Practice for Commissioning Building Electrical Systems* [ANSI]
 - c. NECA 100, *Symbols for Electrical Construction Drawings* [ANSI]
 - d. NECA 101, *Standard for Installing Steel Conduits (Rigid, IMC, EMT)* [ANSI]
 - e. NECA 104, *Recommended Practice for Installing Aluminum Building Wire and Cable* [ANSI]
 - f. NECA / NEMA 105, *Recommended Practice for Installing Metal Cable Tray Systems* [ANSI]
 - g. NECA 111, *Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC)* [ANSI]
 - h. NECA / NACNA 120, *Standard for Installing Armored Cable (Type AC) and Metal-Clad Cable (Type MC)*[ANSI]
 - i. NECA 202, *Recommended Practice for Installing and Maintaining Industrial Heat Tracing Systems* [ANSI]
 - j. NECA 230, *Standard for Selecting, Installing and Maintaining Electric Motors and Motor Controllers* [ANSI]
 - k. NECA 331, *Standard for Building and Service Entrance Grounding and Bonding*
 - l. NECA 400, *Standard for Installing and Maintaining Switchboards* [ANSI]
 - m. NECA 402, *Standard for Installing and Maintaining Motor Control Centers* [ANSI]
 - n. NECA / EGSA 404, *Standard for Installing Generator Sets* [ANSI]
 - o. NECA 407, *Recommended Practice for Installing and Maintaining Panelboards* [ANSI]
 - p. NECA 408, *Recommended Practice for Installing and Maintaining Busways* [ANSI]
 - q. NECA 409, *Recommended Practice for Installing and Maintaining Dry-Type Transformers* [ANSI]
 - r. NECA 410, *Recommended Practice for Installing and Maintaining Liquid-Filled Transformers* [ANSI]
 - s. NECA 411, *Recommended Practice for Installing and Maintaining Uninterruptible Power Supplied (UPS)* (ANSI)
 - t. NECA 420, *Standard for Fuse Applications* [ANSI]

- u. NECA 430, *Standard for Installing Medium-Voltage Metal-Clad Switchgear* [ANSI]
- v. NECA / IESNA 500, *Recommended Practice for Installing Indoor Lighting Systems* [ANSI]
- w. NECA / IESNA 501, *Recommended Practice for Installing Exterior Lighting Systems* [ANSI]
- x. NECA / IESNA 502, *Recommended Practice for Installing Industrial Lighting Systems* [ANSI]
- y. NECA / MACSCB 600, *Recommended Practice for Installing and Maintaining Medium-Voltage Cable* [ANSI]
- z. NECA / NEMA 605, *Installing Underground Nonmetallic Utility Duct* [ANSI]
- 10. NEMA – National Electrical Manufacturers Association
- 11. NETA – International Electrical Testing Association, Inc.:
 - a. NETA ATS, *Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems*
 - b. NETA MTS, *Maintenance Testing Specifications for Electrical Power Distribution Equipment and Systems*
 - c. NETA ETT, *Standard for Certification of Electrical Testing Technicians* [ANSI]
- 12. NFPA – National Fire Protection Association:
 - a. NFPA 20®, *Standard for the Installation of Stationary Pumps for Fire Protection*®
 - b. NFPA 70™, *National Electrical Code*® (NEC®)
 - c. NFPA 70E, *Standard for Electrical Safety in the Workplace*.
 - d. NFPA 101®, *Life Safety Code*®
 - e. NFPA 110, *Standard for Emergency and Standby Power Systems*
 - f. NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*
 - g. NFPA 780, *Standard for the Installation of Lightning Protection Systems*
 - h. All other NFPA codes and standards except NFPA 5000
- 13. OSHA – Occupational Safety and Health Administration
- 14. IECC – International Energy Conservation Code
- 15. ISO – International Organization for Standardization
- 16. State and Local Energy Conservation Code
- 17. Applicable County and Municipal Codes

1.5 CONTRACT DRAWINGS

- A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.
- B. Every effort has been made by the Engineer to indicate wiring of all receptacles, light fixtures, switches, telephone outlets, HVAC equipment, other equipment, elevator equipment, and all other devices / appliances requiring electrical power. It is the intent of the Engineer that all light fixtures be powered and controlled unless specifically noted on the plans; that all wiring devices (receptacles and direct connected equipment) be circuited to a power source of the correct voltage and that all HVAC, elevator equipment and other equipment be properly wired to the correct voltage power source; that all communications and security systems devices and equipment and all fire alarm system devices and equipment are installed, wired and systems are fully operational.
- C. It is the responsibility of the Contractor to review the construction drawings (reflected ceiling plans) for light fixtures, casework elevation details for electrical devices which are not indicated on the electrical drawings; to review the mechanical and plumbing documents and all other drawings to determine the electrical rough-ins for all equipment requiring power connections, and to include in their proposals the correct and complete

- electrical rough-ins for all of these items which were inadvertently not indicated on the electrical drawings, OR the Contractor shall specifically enumerate each item requiring electrical rough-in which is not specifically shown on the electrical drawings, and indicate the electrical provisions of these items as specifically excluded from his proposal.
- D. It is the responsibility of the Contractor to compare the scale of all electrical drawings with the scale of the architectural drawings and make adjustments to all electrical drawings which have the incorrect drawing scale so that his material takeoffs are not in error due to an incorrectly labeled drawing scale and his proposal is complete.
- E. No proposal shall be accepted which specifically excludes any of the provisions of paragraphs B, C, or D above.

1.6 PROJECT RECORD DOCUMENTS

- A. Maintain at the job site a separate set of white prints (black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is significantly at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various major and minor feeders, equipment, and other pertinent items, as installed. Record underground and under slab service and feeders installed, dimensioning exact location and elevation of such installations.
- B. At conclusion of project, obtain without cost to the Owner, electronic PDF and AutoCAD 2014 and / or Revit CAD files of the original drawings and transfer as-built changes to these. Provide the following as-built documents including all contract drawings regardless of whether corrections were necessary and include in the transmittal: "2 sets of CDs and prints for Owner's use, one set of CDs, prints, and mylars for Architect / Engineers Records". Delivery of these as-built electronic, reproducible and prints is a condition of final acceptance.
1. 3 sets of electronic AutoCAD (2014 dwg) and / or Revit CAD drawing files, on CD-ROM media, of each contract as-built drawing.
 2. One reproducible Dayrex Mylar film positive of each contract as-built drawing.
 3. Three sets of blue-line prints of each contract as-built drawing.
 4. Three sets of pdf prints of each contract as-built drawing on CD.
- C. As-Built Drawings should indicate the following information as a minimum:
1. Indicate all addendum changes to documents.
 2. Remove Engineer's Seal, name, address, and logo from drawings.
 3. Mark documents RECORD DRAWINGS.
 4. Clearly indicate: DOCUMENT PRODUCED BY:
 5. Indicate all changes to construction during construction. Indicate actual routing of all conduits, etc. that was deviated from construction drawings.
 6. Indicate exact location of all underground electrical raceways, and elevations.
 7. Correct schedules to reflect (actual) equipment furnished and manufacturer.
 8. During the execution of work, maintain a complete set of Drawings and specifications upon which all locations of equipment, devices, and all deviations and changes from the construction documents in the work shall be recorded.
 9. Exact location of all electrical equipment in building. Label panel schedules to indicate actual location.
 10. Exact location of all electrical equipment in and outside of the building.
 11. Exact location of all outdoor lighting poles and equipment.
 12. Location, size and routing of all feeder conduits, equipment, etc. shall be accurately and neatly shown to dimension.
 13. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
 14. Cloud all changes.
 15. Update all panel schedules with all additional circuits added or deleted through construction. Identify each circuit to include all information specified for directory

cards for circuit identification in panelboards.

1.7 SPACE REQUIREMENTS

- A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.8 RELATION WITH OTHER TRADES

- A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements. Extend electrical services and final connections to all items requiring same.
- B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.
- C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.
- D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.
- E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under other Division. Determine from the General Contractor / Construction Manager for the various trades, the Owner, and by direction from the Architect / Engineer, the exact location of all items. The construction trades involved shall furnish all roughing-in drawings and wiring diagrams required for proper installation of the electrical work.
 - 1. Make final electrical connections to all electrically operated equipment indicated on the drawings, except as noted.
 - 2. The responsibility for alignment of motor and driven equipment is specified in the related division.
- F. Request all Shop Drawings required in ample time to permit proper installation of all electrical provisions.
- G. Extend services as indicated to the various items of equipment furnished by others. Rough-in for the various items and make final connections ready for operation upon placing of the equipment.

1.9 CONCEALED AND EXPOSED WORK

- A. When the word "concealed" is defined as hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is defined as open to view, in plain sight.

1.10 GUARANTEE

- A. Guarantee work for 1 year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. Replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

- A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

- A. Select equipment to operate with minimum noise and vibration. If noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts

or other parts of work, and judged objectionable by the Owner, Architect, or Engineer, rectify such conditions at no additional cost to the Owner. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

- A. Manufacturers names and catalog number specified under sections of Division 26 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, materials, energy efficiency characteristics (where applicable) and lighting performance characteristics (where applicable) equal to that specified, manufactured by a named manufacturer shall be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before proposal due date. Submit a marked-up set of the relevant specification section indicating all variances, a comparison to the specified product, and of construction and performance criteria, complete design and performance data for the specified product and the proposed substitution for comparison to the Engineer. The Architect issues approvals of acceptable manufacturers as addenda to the Construction Proposal Documents.

1.14 UTILITIES, LOCATIONS AND ELEVATIONS

- A. Locations and elevations of the various utilities included within the scope of this work:
1. Obtained from utility maps and other substantially reliable sources.
 2. Are offered separate from the Contract Documents as a general guide only without guarantees to accuracy.
- B. Examine the site and verify the location and elevation of all utilities and of their relation to the work. Existing utilities indicated on the site plans are for reference only and shall be field verified by the Contractor with the respective public or private utility.

1.15 OPERATING TESTS

- A. After all electrical systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect / Engineer and Owner. Provide minimum 24-hour advance notice of scheduling of all tests. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.16 WARRANTIES

- A. All normal and extended warranties shall include parts, labor, miscellaneous materials, travel time, incidental expenses, normal freight / shipping, refrigerant, oils, lubricants, belts, filters and any expenses related to service calls required to diagnose and correct warranty problems.
- B. Manufacturer's warranty shall be from one year from date of substantial completion. Contractor shall be responsible for extending the warranties regardless of date of installation or commissioning.
- C. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.17 BUILDING CONSTRUCTION

- A. It shall be the responsibility of the sub-contractor to consult the Contract Drawings, details and specifications and thoroughly familiarize himself as to the construction and all job related requirements. All construction trades shall cooperate with the General

Contractor / Construction Manager Job site superintendent and lay out work so that all raceways and other items are placed in the walls, furred spaces, chases, etc., so that there shall be no delay in the job.

1.18 TEMPORARY FACILITIES

- A. General: Refer to Division 1 for general requirements on temporary facilities.
- B. Temporary Wiring: Temporary power and lighting for construction purposes shall be provided under this Division. Installation of temporary power shall be in accordance with NEC Article 527.
- C. Temporary facilities, wire, lights and devices are the property of this Contractor and shall be removed by this Contractor at the completion of the Contract.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 IDENTIFICATION OF EQUIPMENT

- A. Identification of Equipment:
 - 1. All major equipment shall have a manufacturer's label identifying the manufacturer's address, equipment model and serial numbers, equipment size, and other pertinent data. Take care not to obliterate this nameplate. The legend on all nameplates or tags shall correspond to the identification shown on the Operating Instructions. All panels, cabinets, or equipment requiring 120 volt or higher power shall be labeled as required which includes circuit designation and circuit panelboard location, regardless of which discipline installs the equipment.
 - 2. Three layer laminated plastic engraved identifying nameplate shall be permanently secured to each switchboard, distribution panel, motor control center, transformer, panelboard, safety disconnect switch, enclosed circuit breaker, transfer switches, remote generator transfer devices not installed inside light fixtures, wireway, busduct plug, terminal cabinet, surge protective device, capacitor, individual motor controller, contactor, fire alarm panels (main and remote booster), and communications (voice, data, video) cabinet or rack, security panels, time clocks, BMCS cabinets, sound reinforcement cabinets and racks, miscellaneous control cabinets, equipment integral disconnect switches, toggle or motor switches, disconnects for equipment, exterior junction boxes, exterior pull boxes, exterior wireways and gutters, and rooftop equipment (i.e.: supply and exhaust fans, rooftop HVAC equipment) with stainless steel screws.
 - a. Utility Power: White letters on black background
Generator Power (White letters on red background
UPS Power: White letters on blue background
Load Bank Circuits: White letters on green background
Solar or Wind Power Generation: White on orange background
 - b. Identifying nameplates shall have 1/2-inch high, engraved letters for equipment designation and 1/4-inch letters indicating source circuit designation, (i.e.: "PANEL HA –fed from MDP-6 located in Mech. Rm. 100"). The words "fed from" and "located" shall be included in the labeling.
Example: Panel HA
 Fed From MSB
 Located Main Elec. RM 100
Example: Disconnect for Panel LK
 Location: Kitchen
 Fed From Transformer TLK
 Located Main Elec. RM 100
 - c. Each switchboard, distribution panel, transfer switch, generator transfer

- device (GTD) for emergency lighting, and motor control center feeder or branch circuit device shall have a nameplate showing the load and location of load served in ¼-inch high, engraved letters. Circuit breaker name and kirk key designation if applicable
- d. Each section of multiple section panelboards shall also indicate panelboard section number (i.e.: Panel “HA-Section 2 – fed from MDP-6 located in Mech. Rm. 100”)
 - e. Motor Controllers, starters, and contactors: Provide neatly typed label inside each motor controller and contactor enclosure door identifying motor or load served, nameplate horsepower, full load amperes, code letter, service factor, and voltage / phase rating.
 - f. Individual motor controller and contactor nameplates shall include load served, location of load served, panel and circuit numbers serving load, location of panel serving load, panel and circuit number serving control circuit, location of panel serving control circuit (if different from panel serving load), description and location (if applicable) of control controlling contactor (i.e. Controlled: Switch in RM 100, and Controlled: BMCS). Contactor nameplate is to include whether it is a lighting or receptacle contactor and name of contactor. i.e. C-1.

Lighting Contactor Example	Receptacle Contactor Example
Lighting Contactor C1 West Parking Lot Pole Lights Fed From Panel HA-2,4,6 Located Main Elec. Rm. 100 Control Circuit-Panel LA 42 Located Main Elec. Rm. 100 Controlled-BMCS	Receptacle Contactor C2 Table Recpts Lab Rm 100 Fed From Panel LA-2,4,6,8 Located Mech. Rm. 110 Control Circuit-Panel LA-42 Controlled-Emer Shut Off Mushroom Switch Rm 101
GTD Example	
Exterior lighting wall packs / north soffit / west metal canopy Fed from Panels EHA-2 located in Elec. RM 105 and HA-1 via Lighting Contactor controlled by BMCS located in Elec. RM 200.	

- g. Exterior J-boxes, pull boxes, and gutters shall have panel identification, circuit numbers, and location of panel listed on name plate. Low voltage shall be identified per contents, examples: DATA, BMCS, F/A
- h. Name plates on equipment served from switchboards, distribution panels, I-Line panels, and motor control centers are not to include circuit numbers shown on drawings as the circuit numbers are for construction drawing purposes only.
- i. Panel names for 277/480v shall start with the letter “H” and 120/208v, 120/240v shall start with the letter “L”. No panel shall be named to include a number other than multi sectional panels, example HA-section 2. New panels installed in renovation or site additions shall have names approved or designated by Owner’s electrical representative. Panel names shall not include the letter “I”. Transformer names shall start with the letter “T” followed by the panel name it serves, i.e. TLA.
- j. Main service ATS label shall include equipment name, emergency source and location, normal power source and location, panel served and location. Wall mounted ATS serving lighting loads shall include type of lighting and location, emergency panel and circuit ID and location of panel, normal panel and circuit ID and location of panel.

Main Service ATS Example ATS-1	Wall Mounted Lighting ATS Example ATS
Emer Power-Emer Generator Located Chiller Yard	Exterior Wall Packs/Soffit Lights North/West Metal Canopy Lights
Normal Power-MSB Located-Mech Rm 100	Fed from EHA-2 Located Mech Rm 200
Serves Panel EHA Located-Mech Rm 100	Fed From HB-4 Located Mech Rm 150

- k. Name plates shall include rated bus amperage, voltage, number of phases, number of wires and type of essential electrical system as applicable.
- l. Switchgear, switchboards, panelboards, motor control centers, or service equipment available fault current labeling: Provide a 2x3 inch permanently affixed (notice) label with white lettering on contrasting blue background permanently affixed to the equipment prior to energizing the equipment. The label shall include the date of installation and the date of calculation and comply with ANSI Z535.4 current standards design and durability. The date of calculation shall be the date indicated by the Engineer of Record's seal on the Construction Documents. Example:

AVAILABLE FAULT CURRENT: ##, ### AMPS
DATE OF INSTALLATION: MM/DD/YY
DATE OF CALCULATION: MM/DD/YY

- 3. Cardholders and directory cards shall be furnished for circuit identification in panelboards. Cardholder shall be located on inside of panel door and shall be in a metal frame with clear plastic front. Circuit lists shall be typewritten. Circuit descriptions shall include explicit description and identification of items controlled by each individual breaker, including final graphics room number or name designation and name of each item served. If no building appointed room number or name is given, list locations per the following examples – A. Storage in Rm 100 – B. Office in Rm 100 – C. Storage west of Rm. 100. List corridors as "corridors". Identify circuits controlled by contactors using a separate notation for each contactor used. List notation at bottom of schedule stating the circuits are controlled by a contactor, list exact location of contactor, and how switched. Do not use architectural room number designation shown on plans. Obtain final graphics room number identification from Architect's final room number graphics plan. All locations served by breakers shall be listed on schedule. Panel schedule shall be large enough to contain all information required. Also refer to Section 26 24 16.
 - 4. Permanent, waterproof, black markers shall be used to identify each lighting and power grid junction box, gutter and wireway. Clearly indicate the panel and branch circuit numbers available at that junction box, gutter or wireway. Where low voltage relay panels are used for lighting control, identify the low voltage relay panel and number in addition to the branch circuit panel and number.
 - 5. Pull Boxes, Transformers, Disconnect Switches, etc.: Field work each with a name plate showing identity, voltage and phase and identifying equipment connected to it. The transformer rating shall be shown on the panels or enclosures. For an enclosure containing a motor starter, the nameplate shall include the Owner's motor number, motor voltage, number of motor phases, motor load being serviced, motor horsepower, and motor full load current. Nameplates shall also indicate where panel is fed from.
- B. Prohibited Markings: Markings intended to identify the manufacturer, vendor, or other source from whom the material has been obtained are prohibited for installation in public,

tenant, or common areas within the project. Also prohibited are materials or devices that bear evidence that markings or insignias have been removed. Certification, testing (example, Underwriters Laboratories), and approval labels are exceptions to this requirement.

- C. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of electrical facilities. Provide text of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with industry standards for color and design.
- D. Wire and Cable Markers: Provide vinyl cloth markers with split sleeve or tubing type, except in manholes provide stainless steel with plastic ties.
- E. Wire and Cable Labeling: Provide wire markers on each conductor in all boxes, pull boxes, gutters, wireways, contactors, and motor controllers and load connection. Identify with panelboard / switchboard branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on equipment manufacturer's shop drawings for control wiring.
- F. Underground Warning Tape: Thomas and Betts or approved equal. Six-inch wide plastic tape, colored red for 50 volts or above electrical, or orange for communications and control with suitable warning legend describing buried electrical lines; telephone lines and data lines per APWA recommendations. All underground electrical conduits shall be so identified. Tape shall be buried at a depth of 6-inches below grade and directly above conduits or ductbanks. Provide magnetic marking tape below all underground electrical conduits.
- G. Lighting Controls and Equipment: Provide self-adhesive machine typed tape labels with ¼" high white letters on ½" tall black background for digital lighting modules as "DLM". Modules or relays located above ceiling: adhere label to bottom of ceiling T-grid below relay location. Modules or relays located in mechanical or electrical rooms or other areas other than above ceiling: Adhere label to the cover of the module or relay and identify the area they control as "MAIN GYM", "BAND HALL", or "CORRIDOR 100", etc. Remote lighting control switches or push button stations located remotely from the area they control: Adhere label to device face plate, not obstructing screw fasteners, and intuitively identify function such as "GYM LTG LOW-HIGH" or "CAFE LTG DIM", etc.

3.2 CUTTING AND PATCHING

- A. General: Comply with the requirements of Division 1 for the cutting and patching of other work to accommodate the installation of electrical work. Except as authorized by the Architect / Engineer, cutting and patching of electrical work to accommodate the installation of other work is not permitted.

3.3 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to substantial completion, conduct an on-site training program to instruct Owner's operating personnel in the operation and maintenance of the electrical systems.
 - 1. Provide the training during regular working day.
 - 2. The Instructors shall be experienced in their phase of operation and maintenance of the electrical systems and with the project.
 - 3. Refer to other specification sections for additional training and commissioning requirements.
- B. Time to be allocated for instructions.
 - 1. Minimum of 20 hours dedicated instructor time
 - 2. 4 hours on each of 5 days
 - 3. Additional instruction time for specific systems as specified in other Sections.
- C. Before on-site training, submit the program syllabus; proposed time and dates; for review and approval, minimum 48 hours prior to proposed training time and date.
 - 1. One copy to the Owner
 - 2. One copy to the Architect / Engineer

- D. The Owner shall provide a list of personnel to receive instructions, and shall coordinate their attendance at the agreed upon times.
- E. Use operation and maintenance manuals as the basis of instruction. Review manual with personnel in detail. Explain all aspects of operation and maintenance.
- F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.
- G. Demonstrate equipment functions (both individually and as part of the total integrated system).
- H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.
- I. Submit a report within one week after completion of training. List time and date of each demonstration, hours devoted to the demonstration, and a list of people present, with their respective signatures.
- J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he / she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.
- K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.4 OPENINGS

- A. Framed, cast or masonry openings for boxes, equipment or conduits are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.5 HOUSEKEEPING PADS

- A. Provide concrete equipment housekeeping pads under all floor and outdoor mounted electrical equipment.
- B. Concrete and reinforcing steel shall be as specified in Division 3, or as indicated or noted.
- C. Concrete pads:
 - 1. 6-inches thick minimum indoors; 8-inches thick minimum outdoors, or match existing if indicated on the drawings to extend existing pads, or in other sections of the specifications.
 - 2. Chamfer strips at edges and corner of forms.
 - 3. Smooth steel trowel finish.
 - 4. Extend 3-inches minimum indoors beyond perimeter of equipment unless otherwise shown.
 - 5. 6-inch x 6-inch #8 wire reinforcement mesh.

3.6 OBSTRUCTIONS

- A. The drawings indicate certain information pertaining to surface and subsurface obstructions, which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
 - 1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
 - 2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
- B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.7 VANDAL RESISTANT DEVICES

- A. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used, and 25 percent spare fasteners.
- B. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.8 PROTECTION

- A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.
- B. Do not deliver equipment to this project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather shall be rejected, and the contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

3.9 COORDINATION OF BRANCH CIRCUIT OVERCURRENT AND PROTECTION DEVICES

- A. Review with equipment specified which requires electrical connections. Review equipment shop drawings and manufacturer's nameplate data and coordinate exact branch circuit overcurrent protective device and conductors with equipment provided.
 - 1. Provide equipment manufacturer's recommended overcurrent protective device indicated on nameplate at no additional cost to the Owner.
 - 2. If branch circuit conductors and / or conduit sizing is less than the minimum required by equipment manufacturer, notify the Architect / Engineer immediately, prior to rough-in.
 - 3. If equipment manufacturer is a substitution to the specified equipment manufacturer, provide the greater of the conductors specified or those required for the installed equipment manufacturer's minimum circuit conductors, at no additional cost to the Owner.
 - 4. If conductors indicated on plans are in excess of that permitted by equipment manufacturer, notify Architect / Engineer immediately, prior to rough-in.
 - 5. If conductors indicated on plans are in excess of that permitted by the equipment manufacturer, provide the maximum conductors permitted by the equipment manufacturer based on NEC ampacity tables, either in a single set, or as a set of parallel conductors as permitted by the NEC. Conductor size and quantity entering the equipment enclosures shall not exceed the equipment manufacturer's maximum recommendations.

3.10 FAULT CURRENT AND ARC FLASH STUDY FOR OVERCURRENT DEVICE COORDINATION

- A. Contractor shall provide a coordination study, fault current analysis, and Arc-Flash study report for new electrical distribution equipment downstream to the last new overcurrent device in each feeder or branch circuit, conducted and prepared by the switchgear manufacturer. The coordination study and fault current analysis shall include the manufacturer's recommendations for all adjustable overcurrent devices specified or provided. Study does not require inclusion of existing switchgear, except it shall include existing or new overcurrent devices in existing switchgear serving new switchgear. Contractor shall submit the report results prior to submitting switchgear submittals to allow changes or modifications to equipment selection.
- B. Contractor shall adjust all overcurrent device settings based on manufacturer's recommendations, or as directed by Owner / Architect at no additional cost to Owner. Settings for GFI shall be set at maximum as permitted by the NEC.
- C. Arc-Flash & Shock-Hazard Warning Labels: Provide arc-flash and shock hazard-warning labels that comply with ANSI Z535.4 on switchgear, switchboards, transformers, motor control centers, panelboards, motor controllers, safety switches, industrial control panels and other equipment that is likely to require examination, adjustment, servicing, or

maintenance while energized. Locate the marking to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment. On renovation projects, install arc-flash warning labels on existing equipment where lock-out / tag-out will be required for the renovation work. Provide the information listed below on each label. Specify that arc-flash warning label information be produced by the electrical equipment manufacturer or supplier as a part of the final power system studies to be submitted by the Contractor in accordance with the electrical acceptance testing.

1. Note: In addition to the final arc-flash analysis, the final power system studies include load flow and fault-current calculations, and an overcurrent protective device (OCPD) coordination study based on the actual equipment to be installed for the project.
- D. Information to be determined and applied to electrical equipment:
1. Arc-Flash Protection Boundary
 2. Arc-Flash incident energy calculated in accordance with IEEE Std 15841™
 3. Working distance calculated in accordance with IEEE Std 1584a™
 4. NFPA 70E Hazard / Risk Category Number or the appropriate personal protective equipment (PPE) for operations with doors closed and covers on.
 - a. Typical operations include operating circuit breakers, fused switches, and meter selector switches.
 5. System phase-to-phase voltage
 6. Condition(s) when a shock hazard exists (e.g. "With cover off")
 7. Limited Approach Boundary as determined from NFPA 70E, Table 130.2(C)
 8. Restricted Approach Boundary as determined from NFPA 70E, Table 130.2(C)
 9. Prohibited Approach Boundary as determined from NFPA 70E, Table 130.2(C)
 10. Unique equipment designation or code (described under "Component Identification")
 11. Class for insulating gloves based on system voltage (e.g., Class 00 up to 500V)
 12. Voltage rating for insulated or insulating tools based on system voltage (e.g., 1000V)
 13. Date that the hazard analysis was performed.
 14. "Served from" circuit directory information including the serving equipment designation, location (e.g., room number), circuit number, and circuit voltage / number of phases / number of wires.
 15. If applicable, the "serves" circuit directory information including the served equipment designation, location (e.g., room number), circuit number, and circuit voltage / number of phases / number of wires.
 16. An abbreviated warning label may be used where it has been determined that no dangerous arc-flash hazard exists in accordance with IEEE 1584a™, paragraph 9.2.3.
 17. Use a "DANGER" label where the calculated arc-flash incident energy exceeds 40 cal/cm.
- E. Submittals: Submit four copies of coordination study and certified fault current study results to the Architect for review.

3.11 EQUIPMENT BACKBOARDS

- A. Backboards: ¾ inch, fire retardant, exterior grade plywood, painted gray, both sides.
1. Provide minimum of two 4-ft. by 8-ft. sheets of plywood for each new telephone equipment terminal location.
 2. Provide minimum of two 4-ft. by 4-ft. sheets of plywood for each new data / voice / video / communications equipment location / cable TV head end equipment, or security equipment location.

3.12 TESTING

- A. The contractors for the various sub-systems shall submit proposed testing procedures for

their systems, subject to review and approval and Owner acceptance. The contract will not be declared to be substantially complete until the functional operation of the subsystems have been demonstrated and verified and reports have been provided, reviewed and accepted.

- B. The project will not be declared substantially complete until the following has taken place.
1. The “As-Built” drawings have been submitted, reviewed and accepted by the Architect / Owner / Owner’s Construction Representative.
 2. The building emergency lighting system and other systems including but not limited to those listed below have been tested, completed factory start-up and programming and adjusting as required for a complete and fully operational system acceptable to the Architect and Owner.
 - a. Occupancy Sensor and Lighting Controls
 - b. Surge protective device equipment
 - c. Overcurrent devices
 - d. Motor Controllers
 - e. Emergency Lighting
 - f. Building Fire Alarm System

3.13 LOAD BALANCING

- A. Balance the loads on each low-voltage feeder so that the voltage on each phase is within +/- 1.0% of the average voltage of the three phases. Refer to the DOE Office of Industrial Technologies, “Motor Tip Sheet #7” dated September 2005 available for download to PDF format at no charge at:
http://www1.eere.energy.gov/industry/bestpractices/pdfs/eliminate_voltage_un_balanced_motor-systemts7.pdf

END OF SECTION

**SECTION 26 0505
ELECTRICAL ALTERATIONS PROJECT PROCEDURES**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Inspection and service of existing equipment and materials to remain or be reused.
- B. Handling of equipment and materials to be abandoned.
- C. Handling of equipment and materials to be removed.

1.2 QUALITY ASSURANCE

- A. Coordination with the Contractor prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.3 CONTRACT DRAWINGS

- A. There is the possibility that there exist conditions and devices that are affected by the work indicated on the drawings and called for in the specifications (project manual) that do not appear on the drawings. It is the Contractor's responsibility to visit the site and determine all of the existing conditions and to consider these existing conditions when making and presenting a proposal, to have a complete proposal.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Material used to upgrade and repair existing equipment shall conform to that specified.
- B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.
- C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer's approved distribution channels, shall have manufacturer's warranties for the new material being used, and shall be listed for the use intended.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Notify the Architect / Engineer, in writing, accordingly.
- B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect / Engineer, in writing.
- C. Verify field measurements and circuiting arrangements.
- D. Verify that abandoned wiring, panelboards, and switchboards, disconnect switches, and equipment serve only abandoned facilities. Where abandoned wiring, panelboards, switchboards, and equipment which serve existing facilities are to remain, Contractor shall provide means and methods to ensure existing facilities remain energized with the correct voltage, overcurrent protection, conductors, and circuit ampacity required by the existing facilities to remain.
- E. Demolition Drawings are based on casual field observation, and when available, existing record documents. Report discrepancies to Architect before disturbing existing installation, and immediately after such discrepancies are discovered.

3.2 APPLICATION

- A. Existing materials and equipment indicated on the drawings or in the specification to be reused shall be cleaned and reconditioned, including tightening of feeder and bus bar lugs prior to installation and reuse in the modified system.

- B. Remove existing luminaries for alterations/renovations. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. For each luminaire that is taken down for alteration and then reinstalled, replace damaged parts, provide new lamps and, with matching paint, touch-up scratched or abraded areas, and replace cracked, broken or missing lenses or diffusers. Replace unrepairable fixtures with new fixtures.
- C. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and shall be removed from the site.
- D. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner's use.
- E. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner.
- F. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.
- G. Clean and repair existing materials and equipment that remain or are to be reused.
- H. Panelboards Reused and Modified for Renovation: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

3.3 SEQUENCING AND SCHEDULING

- A. Coordinate utility service outages with Utility Company, Architect and Owner.
- B. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits use personnel experienced in such operations.
- C. Existing Electrical Service: Refer to drawings for work in remodeled areas. Where facilities in these areas are to remain in service, any related work to keep the facilities in operation is specified in this Division. Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain written permission from Owner at least 10 business days before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Disclose the extent, exact time and expected duration of the outage in a written request to the Owner.
- D. Remove and replace existing conduit, wiring, outlets, devices, lighting fixtures, panels and appurtenances as occasioned by new or remodeled construction. Re-establish service to lights, switches and devices that may be interrupted by remodeled construction.
- E. Disconnect electrical systems in walls, floors and ceilings scheduled for removal. When outlets are removed, wire shall be pulled out of the conduit back to the nearest remaining box or cabinet.
 - 1. Remove exposed conduit that has been abandoned.
 - 2. Cap conduit beyond the finish line.
 - 3. Provide unswitched circuit leg for emergency battery powered equipment; circuit from same branch circuit breaker as switched normal lighting circuit.
- F. Where new/existing luminaries or devices are shown being connected to existing circuits:
 - 1. Field verify existing system voltage
 - 2. Provide ballast / device to match system voltage
- G. Verify the loading of each circuit affected by remodeling work. The maximum load of any branch circuit shall not exceed 80% of its rating.
- H. Remove equipment, systems, conductors, wiring, raceways, etc. abandoned or not required for existing or new systems. Coordinate with Architect / Owner for salvage by Owner. Remove abandoned / not required raceways and wiring back to nearest box serving load to remain, or back to panel if not serving remaining load.

- I. Existing Power, and Lighting and Appliance Branch Circuit Distribution System: Maintain existing system in service unless as noted or specified otherwise. Disable system only to make switchovers and connections. Notify Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- J. Existing Lighting System: Maintain existing system in service unless as noted or specified otherwise. Disable system only to make switchovers and connections. Notify Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- K. Existing Fire Alarm System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify Owner and local fire service at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- L. Existing Telephone System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify Owner and Telephone Company at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- M. Existing Paging and Sound Reinforcement Systems: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- N. Existing Data Network: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- O. Existing Video Distribution System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- P. Existing Security System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- Q. Existing Video Surveillance System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

3.4 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination as directed by the Owner's representative unless they are not wanted, then it will be the responsibility of this Contractor to remove such items and properly dispose of them. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion, and upon approval of the Owner's representative substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.
 - 1. Remove abandoned electrical distribution equipment, utilization equipment, outlets and accessible portions of wiring, raceway systems, and cables back to the source panelboard, switchboard, switchgear, communications closet, or cabinet. Abandoned wiring and raceways can result from actions that include the

- following:
- a. Equipment is removed or relocated
 - b. Fixtures are removed or relocated
 - c. System is no longer used
 - d. There is no demonstrable near term future use for the existing circuit or raceway system.
2. Leave abandoned electrical equipment, conductors, and material in place only if one or more of the following conditions exist:
 - a. The removal requires the demolition of other structures, finishes, or equipment that is still in use. An example is abandoned conduit above an existing plaster ceiling.
 - b. Removal is not feasible due to hazards, construction methods, or restricted access.
 - c. Removal of abandoned conductors may damage conductors that must remain operational.
 3. Remove conduits, including those above accessible ceilings, to the point that building construction, earth, or paving covers them. Cut conduit beneath or flush with building construction or paving. Plug, cap, or seal the remaining unused conduits. Install blank covers for abandoned boxes and enclosures not removed.
 4. Extend existing equipment connections using material and methods compatible with the existing electrical installation and this division.
 5. Restore the original fire rating of floors, walls, and ceilings after electrical demolition.
 6. Use approved lock-out / tag-out procedures to control hazardous energy sources. Assure that an electrically safe work condition exists in the demolition area before beginning demolition. Where possible, disconnect the building from all sources of electrical power before beginning demolition.
- B. All items to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean, repair, and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore them to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.
- C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner's representative to such items and receive further instructions before removal. Items damaged in repositioning operations are the contractor's responsibility and shall be repaired or replaced by the contractor as approved by the owner's representative, at no additional cost to the Owner.
- D. Conduit and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner's representative. Conduit and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Construction Inspector. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities that must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner's representative hereinbefore specified.
- E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed. Replace existing wiring devices and cover plates with new wiring devices and new cover plates in renovated areas. Any corridor, room, or area indicated to have any new wiring devices installed shall have all of the existing wiring devices and cover plates replaced with new wiring devices and new cover plates.

- F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- G. Disconnect and remove abandoned luminaries. Remove brackets, stems, hangers, and other accessories.
- H. Repair adjacent construction and finishes damaged during demolition and extension work.
- I. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
- J. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.
- K. Existing conduit raceway found to need additional hangers installed and/or junction box covers shall be added at no additional cost to the Owner.
- L. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

3.5 PROTECTION OF THE WORK

- A. Provide adequate temporary support and auxiliary structure as necessary to ensure structural value or integrity of affected portion of work.
- B. Provide devices and methods to protect other portions of work from damage.
- C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

3.6 IDENTIFICATION OF EQUIPMENT IN RENOVATED AREAS

- A. Identification of Equipment: Provide new, typed panel directory cards (and card holders if needed) for existing panelboards located within the renovated areas. Ring out all new and existing circuits within these panelboards as specified in Section 26 05 00 Electrical General Provisions. Do not include the description “existing”. Provide new nameplates for all existing electrical equipment in renovated areas as specified in Section 26 05 00 Electrical General Provisions.

3.7 CORRECTIVE MEASURES FOR DAMAGE DURING CONSTRUCTION IN EXISTING LOW VOLTAGE SYSTEMS

- A. Repairs, equipment replacements, and corrections to low voltage systems due to damage caused by contractor:
 - 1. Notify the Owner immediately of any disruption or damage to any low voltage system.
 - 2. Any disruption or damage to the existing access control system or fire alarm system shall be corrected the same day as the disruption or damage occurred. The access control system and fire alarm system shall be tested daily in the presence of the owner prior to the Contractor leaving the job site each day.
 - 3. For each low voltage system a manufacturer certified contractor and certified technicians shall perform corrective measures to each system component that was functional prior to demolition and renovation and found defective or non-functional within 14-days prior to estimated date of substantial completion.
 - 4. Corrective measures to all low voltage systems to correct components of the low voltage systems found damaged by the contractor shall be completed to the satisfaction of the Owner and Architect / Engineer prior to acceptance of substantial completion at no additional cost to the Owner.

END OF SECTION

**SECTION 26 0510
CONTRACT QUALITY CONTROL**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.2 QUALITY CONTROL PROGRAM

- A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents. Submit a narrative outline of the Quality Control Program or Plan.

1.3 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality. Persons performing electrical work shall be required to be licensed. There shall be on-site supervision at all times, including punch list work, with that person having a minimum of journeyman license. Helpers, apprentices shall have a minimum of apprentice license.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes matching approved samples; all exposed finishes shall be approved by the Architect / Engineer. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide manufacturer's qualified personnel to observe:
 - 1. Field conditions
 - 2. Condition of installation
 - 3. Quality of workmanship
 - 4. Start-up of equipment
 - 5. Testing, adjusting, and balancing of equipment
- B. Manufacturer's qualified personnel shall make written report of observations and recommendations to Architect / Engineer.

1.7 MOCKUPS

- A. Assemble and erect the specified equipment and products complete, with specified anchorage and support devices, seals and finishes.
- B. Do not proceed with any work involving a mock-up, until the related mock up has been approved in writing.
- C. Acceptable mock-ups in place shall be retained in the completed work where possible.
- D. Perform tests and submit results as specified.

1.8 SCHEDULING OF MOCK-UPS

- A. Schedule demonstration and observation of mock-ups, in phases, with Architect / Engineer.
 - 1. Rough-in
 - 2. Finish with all appurtenances in place
 - 3. Demonstrations
- B. Refer to other specification sections for pre-functional checklist for requirements to aid in preparing mock-ups.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIAL

- A. Comply with recognized National rating and approval agencies as well as all codes and ordinances at the federal, state and city levels.

PART 3 - EXECUTION

3.1 ADJUSTMENTS AND MODIFICATIONS

- A. Contractor shall provide all adjustments and modifications as requested by the manufacturer's qualified personnel at no additional cost to Owner.
- B. Coordination Drawings:
 - 1. Electrical room size and location required and to scale
 - 2. Equipment and accessories, switchgear and piping
 - 3. Indicate clearances and service access.

3.2 ELECTRICAL ACCEPTANCE TESTING

- A. Perform electrical acceptance testing and inspections in accordance with the current edition of the International Electrical Testing Association (NETA), *Acceptance Testing Specification (ATS)*.
- B. Perform acceptance testing, inspection, function tests, and calibration to assure that installed electrical systems and components, both Contractor and user-supplied are:
 - 1. Installed in accordance with design documents and manufacturer's instructions.
 - 2. Tested and inspected in accordance with applicable codes and standards (e.g. NFPA 110 and NFPA 111).
 - 3. Ready to be energized.
 - 4. Operational within industry and manufacturer's tolerances.

3.3 INSPECTIONS BY LOCAL AUTHORITY HAVING JURISDICTION (AHJ)

- A. Contractor shall notify design prime consultant and associated Architect / Owner's Construction Manager when he requests an inspection by the AHJ.

3.4 MOCK-UPS

- A. Mock up the light fixture fireproofing for each type of light fixture to be located in fire rated ceilings. Demonstrate that the fire proofing material does not interfere with the mechanical operation of light fixture doors, hinges, or latches.
- B. Mock up a typical classroom, science lab of each type, and computer lab with all wiring devices, all lighting controls, covers plates, rough-in boxes, conduits, MC cables, etc. Provide all conductors from all wiring devices to above ceiling space to demonstrate conduit or MC Cable routing and conductor fill.
- C. Mock up a typical panelboard backbox with Surge Protective Device (SPD) panelboard extension backbox or SPD device.
- D. Mock up ten feet of cable tray including all supports, hardware and bonding.

END OF SECTION

SECTION 26 0512
ELECTRICAL SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Prepare submittals as required by Division 01 and as outlined below.
- B. Provide individual submittals based on the project specification section number and description and only items specified or required in that specific project specification section.
- C. Submit product data shop drawings only for the following items indicated below when included as part of the project specifications, and for items specifically requested elsewhere in the Contract Drawings and Specifications. Architect / Engineer reserves the right to refuse shop drawings not requested for review, typically for basic materials and commodity off-the-shelf materials, and/or to imply that materials shall be provided as specified without exception.
- D. The term submittal, as used herein, refers to all:
 - 1. Shop Drawings
 - 2. Coordination Drawings
 - 3. Product data
- E. Submittals shall be prepared and produced for:
 - 1. Distribution as specified
 - 2. Inclusion in the Operating and Maintenance Manual, in the related O&M manual section.

1.2 ARCHITECT / ENGINEER REVIEW OF SUBMITTALS

- A. The Architect / Engineer will:
 - 1. Review requested submittals with reasonable promptness. Specific equipment submittal within a materials specification section that may be required to be expedited shall be submitted separately without other submittal items not requiring the same prompt attention.
 - 2. Affix stamp and initials or signature and indicate requirements for resubmittal or exceptions to submittal as submitted.
 - 3. Return submittals to Contractor for distribution or for resubmission.
- B. Review of submittals will not extend to design data reflected in submittals that is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.
- C. Architect / Engineer's review is only for conformance with the design concept of the project and for compliance with the information given in the contract.
 - 1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
 - 2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes, or coordination with the work of other trades.
- D. The review of a separate item as such will not indicate approval of the assembly in which the item functions.

1.3 SUBSTITUTIONS

- A. Do not make requests for product or material substitution employing the procedures of this Section. The procedure for making a formal request for substitution is specified in Division 01.

PART 2 - PRODUCTS

- A. Each individual submittal shall be an individual specific electronic data file with the file name resembling the product specification section number and title. Refer to Division 01 for additional data file format and media requirements.

PART 3 - EXECUTION

3.1 SPECIFICATION COMPLIANCE REVIEW

- A. Do not submit an outline form of compliance, submit a complete copy with the product data.
- B. Mark up a complete copy of the complete specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:).
- C. Variances for product of materials typically include updated model numbers or updated versions of the specified product from the same manufacture or an equal or better product from the approved manufactures list. Substitutions from manufacture's not on the approved manufacture's will not be reviewed unless prior approval using one of the procedures for substitutions or changes in the contract documents are followed as required in Division 01.

3.2 COMPOSITE COORDINATION DRAWINGS

- A. Produce a set of composite coordination drawings for above ceiling, below ceiling, and below floor of electrical, mechanical, and technology equipment rooms and equipment yards for review and comment within four (4) weeks of receipt of Owner's official Notice to Proceed. Show coordination of items including but not limited to structural and architectural elements, all mechanical and plumbing piping, ductwork, equipment, electrical conduit, low voltage communications and safety/security systems cabling, cable trays, lighting, electrical switchgear, generators and UPSs, and any public or private building utility services.
 - 1. Prepare the composite plans at one-quarter inch (1/4") equals one-foot scale. Include larger scale sections with vertical elevations of elements as required to confirm coordinate of all elements.
 - 2. For each room containing major electrical switchgear and each outside equipment area with major electrical switchgear and other equipment also include NEC working space, NEC equipment space, and NEC access to NEC working space, and housekeeping pad location and dimensions.
 - 3. Prepare coordination drawings to coordinate installations for efficient use of available space allowing for future additional equipment wherever possible, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
 - 4. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- B. Submit composite coordination shop drawings in plan, elevation and sections, showing receptacles, outlets, electrical and telecommunication devices in casework, cabinetwork and built-in furniture.
 - 1. Verify location of wiring devices and outlets, communication devices and outlets, safety and security devices, and other work specified in this Division.
 - 2. Coordinate with drawing details, site conditions, composite coordination drawings, and millwork other equipment shop drawings prior to installation.
 - 3. Submit coordination and shop drawings prior to rough-in and fabrication.

3.3 EQUIPMENT SHOP DRAWINGS AND PRODUCT DATA

- A. Submittals shall not be combined or bound together with any other material submittal. Do not submit entire product catalogs, submit only specific data sheets indicating required product information and available product options or accessories.
- B. Submittal Specification Information:
 - 1. Every submittal document shall bear the following information as used in the

- project manual:
- a. The related specification section number
 - b. The exact specification section title
 - c. Additional identifiers as required in Division 01.
2. Submittals delivered to the Architect / Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been submitted or delivered.
- C. All product options specified shall be clearly indicated on the product data submittal. All options listed on the standard product printed data not clearly identified as either part of or not part of the product data submitted shall become part of the Contract and shall be assumed to be provided with the product submitted.
 - D. Mark each copy of standard manufacturer's printed data to identify pertinent products, referenced to specification section and article number.
 - E. Show reference standards, performance characteristics and capacities; wiring diagrams and controls; component parts; finishes; dimensions and required clearances.
 - F. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete or strike through information not applicable.
 - G. Submit drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
 - H. Show all dimensions of each item of equipment in its to be installed assembled condition with all components assembled. Include a series of drawings of individual components as necessary for reference.
 - I. Identify field dimensions; show relation to adjacent or critical features or work or products.
 - J. Submit individually bound shop drawings and product data for the following when specified or provided.
 - K. The Fault Current and Overcurrent Device Coordination Analysis shall be submitted prior to other electrical switchgear dependent on the results of the study for specific product selection by the vendor or contractor for compliance with the study.
 1. The emergency life safety power system equipment shall be fully coordinated as required by the NEC.
 2. The AIC and WCR ratings of all products meet or exceed the available fault current at that equipment's location.
 3. Electrical systems other than life safety power systems shall be coordinated as much as practicable while reducing arc flash energy as much as practical.
 - L. Required submittals when products are indicated or specified:
 1. Fault Current and Overcurrent Device Coordination Analysis. Submit this analysis three (3) weeks prior to any overcurrent device submittal to allow modifications to overcurrent device product selection submittal based on the manufacturer's analysis and recommendations at no additional cost to the Owner.
 2. Enclosed Switches and Circuit Breakers
 3. Enclosed Motor Controllers
 4. Panelboards, load centers, and enclosures
 5. Wiring devices
 6. Lighting fixtures
 7. Lighting Controls and Occupancy Sensors
 8. Surge Protection Devices
 9. Site Lighting Poles, Fixtures, Drivers, and Lamps
 10. Electrical controls and time switches
 11. Electrical Contactors
 12. Motor control centers
 13. Transformers
 14. Switchboards
 15. Metering equipment for energy monitoring and usage

16. Emergency/Standby generator sets and transfer switches
17. Surface Raceways
18. Architectural Dimming Systems
19. Theatrical Lighting Systems
20. Sports Lighting Equipment, Fixtures, Poles

3.4 MANUFACTURERS INSTRUCTIONS

- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

3.5 CONTRACTOR RESPONSIBILITIES

- A. Review, make corrections or annotations for clarification of manufacturer supplied data, stamp and sign submittals prior to transmittal.
- B. Determine and verify:
 1. Field measurements
 2. Field construction criteria
 3. Manufacturer's catalog numbers
 4. Conformance with the Contract Documents
- C. Coordinate submittals with requirements of the work and of the Contract Documents.
- D. Notify the Architect / Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
- E. Do not fabricate products, or begin work for which submittals are required, until such submittals have been produced and bear contractor's stamp of acceptance or approval. Do not fabricate products or begin work until return of reviewed submittals with Architect / Engineer's acceptance.
- F. Contractor's responsibility for errors, omissions, or un-approved substitutions in submittals is not relieved whether Architect / Engineer reviews submittals or not.
- G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect / Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations identified by the Contractor on reviewed documents.
- H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
 1. Proper sizes and capacities
 2. That the item will fit in the available space in a manner that will allow proper service; manufacture's and code required clearances.
 3. Construction methods, materials and finishes
- I. Schedule submissions at least 15 days before date reviewed submittals will be needed by the Contractor for processing or for making corrections for re-submittal.
- J. General and Electrical Contractor's Stamp of Approval
 1. The general contractor and the electrical contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
 2. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect / Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.
 3. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's stamp of approval and signature.
 4. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk

of all delays, as if no submittal had been delivered.

3.6 SUBMISSION REQUIREMENTS

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor. Product and equipment related to site work or other trades which require extensive rough-in, foundations, or structural support shall be submitted as soon as possible after given notice to proceed with construction.
- B. Number of submittals required:
 - 1. Coordination Drawings: Submit one electronic data file (pdf) and three opaque reproductions or coordination drawings.
 - 2. Product Data: Submit electronic data PDF files. Refer to Division 01 for specific requirements. PDF files that are 20MB or larger may indicate that a submittal includes information not specifically relevant to the specific product being provided, information not required for the review of the specific product such as a complete product catalog or catalog section. Contractor shall include only the product data required to review the specific products characteristics for compliance with the contract documents.
- C. Accompany submittals with transmittal letter containing:
 - 1. Date
 - 2. Project title and number
 - 3. Contractor's name, address and contact information.
 - 4. The number of each Shop Drawing, Project Datum and Sample submitted
 - 5. Other pertinent data as required in Division 01.
- D. Submittals shall include:
 - 1. The date of submission
 - 2. The project title and number
 - 3. Contract Identification
 - 4. The names of:
 - a. Contractor
 - b. Subcontractor
 - c. Supplier
 - d. Manufacturer
 - 5. Identification of the product
 - 6. Field dimensions, clearly identified as such
 - 7. Relation to adjacent or critical features of the work or materials
 - 8. Applicable standards
 - 9. Identification of deviations from contract documents
 - 10. Suitable blank space for General Contractor and Architect / Engineer stamps
 - 11. Contractor's signed and dated Stamp of Approval.
- E. Coordinate submittals into logical groupings to facilitate interrelation of the several items.
 - 1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
 - 2. Associated items requiring correlation for efficient function or for installation

3.7 RESUBMISSION REQUIREMENTS

- A. Make resubmittals under procedures specified for initial submittals. Re-submittals shall be a complete submittal as if it were the initial submittal unless otherwise instructed in the review comments on the original submittal.
 - 1. Indicate that the document or sample is a resubmittal
 - 2. Identify changes made since previous submittals
- B. Indicate any additional changes which have been made by the contractor other than those requested by the Architect / Engineer.

END OF SECTION

**SECTION 26 0519
CONDUCTORS AND CONNECTORS – 600 VOLT**

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Provide electrical conductors, wire and connector work as shown and specified manufactured in the USA.
- B. Types: The types of conductors and connectors required for the project include the following:
 - 1. 600V building conductors
 - 2. 600V building conductor connectors
 - 3. 600V 2-hour fire rated power cable
- C. Application: The applications for conductors and connectors required on the project are as follows:
 - 1. Power distribution circuitry
 - 2. Lighting branch circuitry
 - 3. Appliance, receptacle, and equipment branch circuitry
 - 4. Motor branch circuitry
 - 5. Control wiring
 - 6. Line voltage
- D. Refer to other specific specification sections for voice, video, data, alarm and instrumentation cables.

1.2 QUALITY ASSURANCE

- A. UL Label: Conductors and connectors shall be UL labeled.

1.3 REFERENCES

- A. Refer to other specific specification sections regarding specialized wiring and connections.

PART 2 – PRODUCTS – Provide products manufactured in the USA

2.1 CONDUCTORS AND CONNECTORS

- A. General: Except as indicated, provide conductors and connectors of manufacturer's standard materials, as indicated by published product information, designed and constructed as instructed by the manufacturer, and as required for the installation.
- B. Conductors: Provide factory-fabricated conductors of the size, rating, material, and type as indicated for each use. Conductors shall be soft or annealed copper wires meeting, before stranding, the requirements of ASTM B 3, Standard Specification for Soft or Annealed Copper Wire for Electrical Purposes, latest edition.
 - 1. Conductors for control wiring sized #14 AWG through #10 AWG shall be stranded.
 - 2. Conductors for power and lighting shall be stranded. Stranding shall be Class B meeting the requirements of ASTM B 8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, or Soft.
- C. Insulation for standard building conductors: Insulation shall meet or exceed the requirements of UL 83, Standard for Thermoplastic Insulated Wires.
 - 1. All wiring inside lighting fixtures shall be temperature rated per NEC.
 - 2. Insulation for copper conductors shall be UL Type THHN/THWN, 90 degrees C.
- D. Insulation for 2-hour fire rated power cables: Insulation shall meet or exceed the requirements of UL 2196 Fire Test for Electrical Circuit Protection Systems, and UL 44,

Standards for Fire Resistive Cable. Conductor ampacity shall be based on 75C. Combination UL Type insulation types are permissible where the required UL Type is part of the combination UL listing.

1. Conductors installed underground: Insulation for underground fire rated conductors shall be wet location, UL Type RHW 75 degrees C, or UL RHW-2 90 degrees C.
 2. Conductors installed above ground: Insulation for above ground fire rated conductors shall be UL Type RHH 90C or RHW 75C or UL RHW-2 90C.
 3. Electrical Circuit Protective Systems (FHIT) – System 27 of the UL Fire Resistance Directory
- E. Cable Lubricant: Fire resistant, nonflammable, water-based type for standard building conductors. Provide cable lubricants for fire rated cables as recommended by the cable manufacturer.

2.2 COLOR CODES FOR CONDUCTORS FOR BRANCH CIRCUITS AND FEEDERS

- A. Color coding for conductors as required by NEC 210.5. Color coding for phase and voltage shall be as required by local codes and local standards. Where such standards do not exist, color coding shall be as follows:

Color Code Table	USE CONTINUOUS COLOR-CODED INSULATION THROUGHOUT					
System/Phase	A	B	C	N	G	IG
120/208 3 Ph	Black	Red	Blue	White	Green	Green/Yellow Stripe
120/240 3 Ph	Black	Orange	Blue	White	Green	Green/Yellow Stripe
120/240 1 Ph	Black	N/A	Blue			
277/480	Brown	Purple	Yellow	Gray	Green	Green/Yellow Stripe

Notes to Color Code Table:

1. 120/208, 120/240, and 277/480 Volt Systems shall be routed in separate raceways.
2. Switched legs of phase conductors for lighting and appliance branch circuits shall be of the same color as described above throughout the entire circuit.
3. Conductors shall be the same color from breaker to device or outlet.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. General: Install electrical conductors and connectors as shown, in accordance with the manufacturer's written instructions, the requirements of NEC, the NECA Standard of Installation, and industry practices.
- B. Coordination: Coordinate conductor installation work with electrical raceway and equipment installation work, as necessary for interface.
- C. Conductors:
1. Provide a grounded (neutral) conductor for each branch circuit. Do not share grounded (neutral) conductors.
 2. No more than six phase conductors shall be installed in a single raceway. Any

- combination of phase conductors and grounded (neutral) conductors in any raceway shall not exceed nine.
3. When any combination of four or more phase and grounded (neutral) conductors are installed in a raceway, the minimum size for all conductors including equipment ground conductor shall be #10 AWG, and they shall be de-rated accordingly.
 4. When more than four (4) conductors are size #10 AWG, they shall be installed in a one-inch conduit.
 5. Pull conductors together when more than one is being installed in a raceway. Whenever possible, pull conductors into their respective conduits by hand. Use pulling lubricant when necessary.
 6. Before any conductor is pulled into any conduit, thoroughly swab the conduit to remove foreign material and to permit the wire to be pulled into a clean, dry conduit.
 7. Run feeders their entire length in continuous section without joints or splices.
 8. No wire smaller than #12 AWG shall be permitted for any lighting or power circuit. No wire smaller than #14 AWG shall be used for any control circuit, unless shown otherwise.
 9. Provide the same size wire from the panelboard to last outlet on circuit. For 20 amp branch circuits operating at 150V or less, provide #10 AWG wire when the first outlet is over 75-feet from the panelboard. For branch circuits operating at 150 to 600 volts, provide #10 AWG wire when the first outlet is over 150-feet from the panelboard.
 10. Branch circuit voltage drop shall not exceed 3% of rated voltage.
 - a. Total voltage drop from the point of service to the last outlet or utilization equipment of the same voltage shall not exceed five-percent of rated voltage.
 - b. Total voltage drop from the point of service to transformers with adjustable taps, buck-boost transformers, uninterruptable power supplies (UPS), or voltage regulators shall not exceed five-percent of rated voltage.
 - c. Total voltage drop from a separately derived system, transformer with adjustable taps, buck-boost transformer, uninterruptable power supply (UPS), or voltage regulator to the last outlet or utilization equipment of the same voltage shall not exceed five-percent of rated voltage.
 - d. Total voltage drop from the point of service to distribution equipment of the same voltage shall not exceed two-percent of rated voltage.
 - e. Branch circuit voltage drop from distribution equipment to the last outlet or utilization equipment shall not exceed three-percent of rated voltage.
 - f. Provide the same size branch circuit conductors to last outlet on circuit unless specifically noted or indicated otherwise on the drawings. For 20 amp branch circuits operating at 150-Volts or less, provide #10 AWG wire when the first outlet is over 75-feet from the panelboard. For branch circuits operating above 150-Volts to 600-Volts, provide #10 AWG wire when the first outlet is over 150-feet from the panelboard.
 11. No tap or splice shall be made in any conductor except in outlet boxes, pull boxes, junction boxes, splice boxes, or other accessible locations. Make taps and splices using an approved compression connector. Insulate taps and splices equal to the adjoining conductor. Make splices or taps only on conductors that are a component part of a single circuit, protected by approved methods. Taps or splices in feed through branch circuits for connection to light switches or

- receptacles shall be made by pigtail connection to the device.
 12. Support conductors in vertical raceways, as required by the NEC.
 13. Do not permit conductors entering or leaving a junction or pull box to deflect to create pressure on the conductor insulation.
 14. Make joints in branch circuits only where circuits divide. These shall consist of one through circuit to which the branch from the circuit shall be spliced.
 15. Make connections in conductors up to a maximum of one #6 AWG wire with two #8 AWG wires using twist-on pressure connectors of required size.
 16. Make connections in conductors or combinations of conductors larger than specified using cable fittings of type and size required for specific duty.
 17. After a splice is made, insulate entire assembly with UL-approved insulating tape to a value equivalent to the adjacent insulation.
 18. Make splices and connections in control circuit conductors using UL-approved solderless crimp connectors.
 19. All conduits shall be installed with an insulated grounding conductor per NEC 250.122. Where green conductor insulation is not available, the ground conductor shall be identified with green phasing tape at all accessible locations.
 20. Neatly train and lace wiring inside boxes, equipment and panelboards. Provide tie-straps around conductors with their shared neutral conductor where there are more than two neutral conductors in a conduit.
 21. Clean conductor surfaces before installing lugs and connectors.
 22. Make splices, taps and terminations to carry full ampacity of conductors with no perceptible temperature rise.
 23. Provide stranded conductors connected with pressure type connectors / compression fittings and terminal lugs UL listed for the type of conductor used (AL-CU) and correctly sized to the diameter of the bare conductors.
 24. Run mains and feeders their entire length in continuous pieces without splices or joints.
 25. Color code conductors.
 26. Do not install a pull string in conduits containing conductors.
 27. Conductors shall be the same color from load side of overcurrent protection device to outlet or utilization equipment.
 28. Spare conductors shall not be installed in any conduit, gutter, raceway, panel or enclosure unless noted otherwise.
- D. Two-hour fire rated cable:
1. Two-hour fire rated power cable shall be installed per manufacturer's installation instructions in compliance with UL Fire Resistance Directory, Electrical Circuit Protective Systems (FHIT), and System 27.
 2. Two-hour fire rated power cable shall be installed in rigid steel EMT or rigid steel galvanized conduit (RGC) with steel fittings. Provide fire rated sealant to the end of the raceway to prevent gases from migrating from the fire rated cable into the equipment.
 3. Provide two-hour rated cable where conduit or cables enters or passes through the building envelope at areas or rooms that are not two-hour rated equipment rooms for the following:
 - a. Fire Pump feeders.
 - b. Emergency Feeders (Life Safety) as defined by NFPA Article 700.
 - c. Legally required level one standby systems as defined by NFPA 110 and NFPA Article 701. These systems include but are not limited to those used to aid firefighting and rescue operations, smoke removal systems, and elevators designated for ADA and/or fire rescue operations.

4. Alternate two hour rated feeder conductor sizes may be substituted for the required conductor ampacity, voltage drop, or equipment lug terminations based on two-hour fire rated conductor standard size availability or provided equipment manufacturer's cable terminations. The substituted conductor ampacity shall meet or exceed the specified cable ampacity and exceed the required equipment minimum circuit ampacity. Provide substitutions and the required conduit sets and sizes as required for the substitutions at no additional cost to the Owner.
- E. Identification: Label each phase conductor in each junction box with corresponding circuit number, using self-adhesive wire markers.
- F. Splices and Joints:
 1. In accordance with UL 486A, C, D, E, and NEC.
 2. Aboveground Circuits (No. 10 AWG and smaller):
 - a. Connectors: Solderless, screw-on, reusable pressure cable type, rated 600 V, 220° F, with integral insulation, approved for copper and aluminum conductors. Push-in type connectors are prohibited.
 - b. The integral insulator shall have a skirt to completely cover the stripped wires.
 - c. The number, size, and combination of conductors, as listed on the manufacturers' packaging, shall be strictly followed.
 3. Motor connections:
 - a. All AHU motors connections shall be split bolt connectors.
 - b. All non-AHU motors 10 HP and larger shall be split bolt connectors.
 - c. All non-AHU motors less than 10 HP shall be split bolt connectors or as recommended by the manufacturer.
- G. Aboveground Circuits (No. 8 AWG and larger):
 1. Connectors shall be indent, hex screw, or bolt clamp type of high conductivity and corrosion resistant material, listed for use with copper and aluminum conductors.
 2. Provide field-installed compression connectors for cable sizes 250 kcmil and larger with not less than two clamping elements or compression indents per wire.
 3. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Splice and joint insulation level shall be not less than the insulation level of the conductors being joined.
 4. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.
- H. Underground Branch Circuits and Feeders:
 1. Submersible connectors in accordance with UL 486D, rated 600 V, 190°F, with integral insulation.

3.2 TESTING

- A. Pre-Energization Check: Before energizing, check cable and conductors for circuit continuity and short circuits. Correct malfunctions.
- B. Service Entrance and Feeder Insulation Resistance Test: Each main service entrance conductor and each feeder conductor shall have its insulation resistance tested after the installation is complete except for connection at its source and point of termination. Testing shall be performed by qualified technicians who have been trained in testing procedures and in the use of all test equipment.
 1. Make tests using a Biddle Megger or equivalent test instrument at a voltage of not less than 1000 VDC; measure resistance from conductor to conductor, conductor to neutral (if present) and from conductor to ground. Insulation resistance shall not be less than the following:

Wire Size (AWG)	Insulation Resistance (Ohms)
#8	250 K
#6 through #2	100 K
#1 through #4/0	50 K
Larger than #4/0	25 K

2. Conductors that do not meet or exceed the insulation resistance values listed above shall be removed, replaced, and retested.
- C. Submittals: Contractor shall furnish instruments and personnel required for tests. Submit 4 copies of certified test results to Architect for review. Test reports shall include conductor tested, date and time of test, relative humidity, temperature, and weather conditions.
 - D. Voltage and Current Values: The voltage and current in each conductor shall be measured and recorded after connections have been made and the conductor is under load.

SAMPLE DC HIGH VOLTAGE CABLE TEST REPORT
(Specification Paragraph 3.2, C)

Date _____

Contract and Work Location: _____

Contract (Project) No.: _____

Circuit Identification: _____
(Dwg., Title, Number and Ckt. Number)

Test Equipment: _____
(Make, Model, Serial No., Etc.)

Applied Test Voltage _____

Normal Oper. Voltage _____

Cable Installation: New _____ Used _____
(Date) (No. Years)

Cable Size _____ AWG

Cable Length _____ Ft.

Cable Material _____ Cu _____ Al

Temperature _____ Humidity _____

TEST DATA - RESISTANCE IN KILO OHMS

CONDUCTOR PER PHASE	A-N	B-N	C-N	A-G	B-G	C-G	A-B	B-C	A-C

END OF SECTION

**SECTION 26 0526
ELECTRICAL GROUNDING**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Grounding shall conform to the requirements of:
 - 1. National Electrical Code.
 - 2. Governing local codes.
 - 3. All Local Utility Companies
- B. Ground effectively and permanently.
 - 1. Neutral conductor at the main service disconnect and other separately derived systems.
 - 2. All conduit systems.
 - 3. All electrical equipment and related current carrying supports or structures.
 - 4. All metal piping systems.
 - 5. All building structural metal frames.
 - 6. All telephone/voice/video/CATV/data utilities

1.2 REFERENCE STANDARDS

- A. ANSI/IEEE Standard 142 - "Recommended Practice for Grounding of Industrial and Commercial Power Systems."
- B. ANSI/UL 467 - "Safety Standard for Grounding and Bonding Equipment."
- C. Article 250 of the NEC (NFPA 70) for grounding.
- D. NECA – Standard of Installation
- E. NETA ATS – Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems
- F. EIA / TIA 607

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Copperweld
- B. nVent ERICO
- C. Burndy
- D. O. Z Gedney
- E. Eaton

2.2 GROUNDING ELECTRODES

- A. Driven Rod Electrode
 - 1. 3/4" x 10'-0" copper clad grounding electrode.
 - 2. UL listed.
 - 3. Approved thermal fusion connector methods (exothermic).
- B. Metal frame of building or enclosure.
- C. Foundation concrete encased rebar.

2.3 DATA / VOICE COMMUNICATIONS CLOSET GROUND BAR

- A. MDF closets/head end rooms: Erico Cadweld #B544A028 ground bar with 7/16-inch holes.
- B. IDF closets, Erico Cadweld #B542A004 ground bar with 7/16-inch holes.
- C. Heavy-duty, two bolt type, copper alloy or bronze for grounding and bonding applications, in configurations required for particular installation.

2.4 EXOTHERMIC CONNECTIONS

- A. Exothermic type for underground and structural steel; Cadweld
- B. Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

2.5 WIRE

- A. Stranded, copper cable
- B. Foundation Electrodes: 4/0 AWG
- C. Grounding Electrode Conductor: Size to meet NFPA 70 requirements

PART 3 - EXECUTION

3.1 GROUNDING AND BONDING

- A. In the service equipment, provide a separate (dedicated) ground bus.
 - 1. Bond the ground bus with copper bus bar or cable, of equal or greater current carrying capacity of the service grounding conductor, to the neutral bar.
 - 2. Resistance of neutral to ground shall not exceed 10 Ohms.
 - 3. Connect the electric service grounding electrode conductors to the incoming metal water pipe system (when available, using a suitable ground clamp) and to a supplemental electrode such as a ground rod or ground ring.
 - 4. Provide grounding and bonding at the power company's metering equipment.
 - 5. Provide access and cover for access to the ground grid and removable connections for testing the system.
- B. Connect the grounding electrode conductor between the ground bus and the grounding electrode system.
 - 1. In rigid PVC conduit.
 - 2. Provide thermo fusion connection for each rod ground electrode.
 - a. All rod electrodes shall be located outside the building in non-paved areas where available. Access cover top shall be flush with finish grade or floor.
 - b. Install rod electrodes as required. Install additional rod electrodes as required to achieve specified resistance to ground.
 - c. The minimum distance between driven ground rod electrodes shall be 10'.
 - 3. The total ground resistance shall not exceed 10 Ohms for service entrance grounds and 25 Ohms for equipment grounds.
 - a. Where this condition cannot be obtained with one electrode, install a longer electrode, deep-driven sectional electrodes, or additional grounding electrodes until the required ground resistance is obtained.
- C. Provide an insulated equipment grounding conductor inside all conduits, raceways, surface raceways, gutters and wireways. The ground wire shall be bonded to each box to suitable lug, bus, or bushing. All bonding jumpers shall be routed inside conduit or raceway.
- D. Provide an insulated isolated equipment grounding conductor in addition to the insulated equipment grounding conductor for all isolated grounding feeders, branch circuits, outlets and isolated grounding receptacles.
- E. Provide all conduit terminating in switchgear, transformers, switchboards, panelboards and voice/data outlets with grounding bushings, where required, and ground wire extended to ground bus in equipment. Install grounding bushings where reducing washers are used and concentric and eccentric knock-outs are used.
- F. Main bus and building grounding electrode conductor installation shall be witnessed by the Architect / Engineer.
- G. Provide bonding to meet Regulatory Requirements.
- H. Interface with lightning protection system when lightning protection system is specified.
- I. Locate and install anchors, fasteners, and supports in accordance with NECA "Standard of Installation".
- J. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- K. Do not use spring steel clips and clamps.
- L. Do not use powder-actuated anchors.
- M. Do not drill or cut structural members.

- N. Do not use compression or mechanical connectors underground.
- O. Do not use sheetmetal or self-drilling screws for bonding connections. Provide listed or approved connectors.
- P. Provide grounding access well for each driven ground electrode, not located in manholes or pull boxes.
 - 1. Access well top shall be flush with finish paved surfaces.
 - 2. Ground access wells located in non-paved areas shall be set two-inches above surrounding finished grade. Provide 12-inch wide by 8-inch deep reinforced concrete crown around neck or opening and sloped down away from pull box opening.
 - 3. Provide thermal fusion (exothermic) connectors approved for direct burial.

3.2 METAL FRAME OF BUILDING OR STRUCTURE

- A. Effectively ground the building steel or structure per NEC 250-52 (2).

3.3 UFER GROUND

- A. Provide a UFER ground at bottom of building slab per NEC 250.52 (3), bond to building steel.

3.4 MISCELLANEOUS REQUIREMENTS

- A. Continuity of the equipment grounding system shall be maintained throughout the project. Equipment grounding jumpers shall be installed across conduit expansion fittings, liquid-tight flexible metal and flexible metal conduit, and other non-electrically continuous raceway fittings.
- B. Equipment grounding conductors and grounding electrode conductor shall be stranded copper conductors and run in a suitable raceway. Grounding conductors and grounding electrode conductor shall be continuous, without joints or splices over their entire length, except as allowed by NFPA 70/NEC.
- C. For separately derived alternating current system grounds, bond the case and neutral of each transformer secondary winding directly to the nearest available effectively grounded structural metal member as required in NEC 250.
- D. Exterior Electrical Equipment Racks:
 - 1. Provide driven ground electrode.
- E. Technology/Data/Voice Communications, CATV, CCTV, and MATV Equipment Grounding: Provide grounding electrode conductor from the communications service equipment to the building grounding system as required. Grounding shall conform to ANSI/TIA/EIA 607(A) – Commercial Building Grounding and Bonding Requirements for Telecommunications, National Electrical Code®, ANSI/NECA/BICSI-568 and manufacturer's grounding requirements as minimum. Bonding shall be of low impedance to assure electrical continuity between bonded elements.
 - 1. MDF Closets Telecommunications Main Ground Bar (TMGB): Provide Erico #EGBA14424MM ground bar, wall mounted to the telecommunications plywood backboard. Provide one #3 AWG insulated ground conductor from ground bar to building steel. Provide #2/0 AWG insulated ground conductor to the building electrical service ground at the nearest electrical switchboard or panelboard.
 - 2. IDF Closets Telecommunications Ground Bar (TGB): Provide Erico #EGBA14410FF ground bar mounted to the telecommunications plywood backboard. Provide one #6 AWG insulated ground conductor from ground bar to building steel and to ground bus of nearest electrical panelboard or switchboard.
 - 3. Provide #2/0 AWG insulated ground conductor between each TMGB and all TGBs.
 - 4. Provide #2/0 AWG insulated ground conductor from TMGB to electrical service ground bus at main electrical service switch.
 - 5. Bond each equipment rack, cabinets, frames, together and with #6 AWG insulated ground conductor to the local TMGB / TGB. Bond and ground

- equipment racks, housings, messenger cables, raceways, and rack-mounted conduit.
- 6. Route TMGB – TGB ground conductor using the shortest, straightest, route practical with long radius curves.
- 7. All conduits terminating to cable trays, wireways, and racks shall be mechanically fastened. When connected to a cable tray or rack, it must be connected with ground bushings, wire bonded to the tray or rack, and grounded to the main building grounding system or IDF room grounding bar using #6 AWG copper.
- F. Ground lighting fixture bodies to the conduit grounding system.
- G. Bond receptacle ground to the box and conduit ground system, except where and insulated/isolated grounding receptacle or outlet is specified.
- H. Ground connections to building steel, grounding electrodes and all underground connections shall be by thermal fusion (exothermic).
- I. Provide OZ Type “BJ” bonding jumper at all expansion joints, points of electrical discontinuity or connections in conduit where firm mechanical bond is not possible, such as flexible connections, insulating couplings, etc.
- J. Ground each lighting and power panelboard by connecting the grounding conductors to the grounding stud.
- K. Ground each secondary dry-type transformer to the ground bus of the primary side panelboard. Provide a bonding jumper between the ground stud and the neutral. Ground transformer ground stud to ground ring if a ground ring is installed or the nearest structural steel member.
- L. Bond every item of equipment served by the electrical system to the building equipment ground system. This includes, but is not limited to, switchboards, panelboards, disconnect switches, receptacles, cable trays, controls, fans, air handling units, pumps and flexible duct connections.
- M. Ground each light pole, power distribution poles, and metal conduit stub-ups at each light pole base.
- N. Ground all metal conduit including metal conduit used for bends and penetrations through concrete.
- O. Bond hot water and cold water piping together at each domestic water heater.

3.5 MANHOLE AND/OR PULL BOX GROUNDING

- A. Provide a driven ground rod and ground bond ring in each power and telephone manhole or pull box. Bond cable racks and medium voltage cable shields at splices and terminations, ductbank conduit ground bushings and all other metal components in manholes or pull box to the ground ring.

3.6 COORDINATION

- A. General: Coordinate installation of grounding connections for equipment with equipment installation work.

3.7 TESTING

- A. Ground Resistance Test: Perform a ground resistance test for comparison to future inspection and testing data by the Owner. Test shall be performed using a Biddle Megger Earth Tester or equivalent test instrument. The test shall not be performed within 48 hours after the last rainfall.
 - 1. Inspect and test in accordance with NETA ATS except Section 4
 - 2. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13
- B. True Root Mean Square (RMS) AC measurements: The True RMS AC Measure test should be performed for all bonding conductors. The recommended maximum AC current value on any bonding conductor should be less than 1 ampere (A). The recommended maximum DC current value should be less than 500 milliamperes (mA). If abnormally high AC current levels are present on any bonding conductor, a dangerous faulty wiring

- condition likely exists within the room.
- C. Two-Point Bonding Measurements: The Two-point Bonding test should be performed for all bonding conductors. This test should be performed using an earth grounding resistance tester configured for a continuity test. The test is performed by connecting the meter leads between the nearest available grounding electrode (e.g., structural steel) and the TMGB or TGB. The recommended maximum value for the bonding resistance between these two points is 0.1 Ohms (100 milliohms).
- D. Submittals: Furnish instruments and personnel required for tests. Personnel shall be trained in all aspects of testing grounding systems and shall be formally trained on using all test equipment required. Submit 2 copies of certified test results for Owner's record and submit 4 copies of certified test results to Architect / Engineer for review. Test reports shall include date and time of tests, relative humidity, temperature, and weather conditions.

END OF SECTION

**SECTION 26 0527
EXPANSION OF EXISTING ELECTRICAL GROUNDING SYSTEM**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Grounding shall conform to the requirements of:
 - 1. National Electrical Code
 - 2. Governing local codes
 - 3. Local Utility Company
- B. Ground effectively and permanently.
 - 1. Verify existing neutral conductor bonding at the main service disconnect and at other new/relocated or reused separately derived systems.
 - 2. All new/relocated conduit or cable tray systems and busway
 - 3. All new/relocated electrical equipment and related current carrying supports or structures
 - 4. All new / relocated metal piping systems
 - 5. All new building structural metal frames

1.2 REFERENCE STANDARDS

- A. ANSI/IEEE Standard 142 - "Recommended Practice for Grounding of Industrial and Commercial Power Systems."
- B. ANSI/UL 467 - "Safety Standard for Grounding and Bonding Equipment."
- C. Article 250 of the NEC (NFPA 70) for grounding.
- D. NECA – Standard of Installation
- E. NETA ATS – Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems
- F. EIA / TIA 607

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Copperweld
- B. nVent ERICO
- C. Burndy
- D. O.Z. Gedney
- E. Eaton

2.2 GROUNDING ELECTRODES

- A. Driven Rod Electrode
 - 1. 3/4" x 10'-0" copper clad grounding electrode, UL listed
 - 2. UL listed grounding electrode connector
 - 3. Approved thermal fusion methods (exothermic)
- B. Metal Frame of Building
- C. Existing grounding electrode system

2.3 DRIVEN ELECTRODE ACCESS BOX AND COVER

- A. Hubbell Tier 22 FRP 20-inch round bolt down cover with "GROUND" embossed on top.

2.4 MATERIALS AND COMPONENTS

- A. Reference other sections of this specifications for materials specified there.
- B. Heavy-duty, copper, two bolt type, copper alloy or bronze compression lugs for grounding and bonding applications, in configurations required for particular installation.

PART 3 - EXECUTION

3.1 SYSTEMS 600 VOLTS OR LESS

- A. In the existing service equipment, field verify existing condition of ground bus.
 - 1. Field verify existing bond of the ground bus to the existing service grounding conductor, to the neutral bar.
 - 2. Tighten existing ground lugs and connections.
- B. Connect the grounding electrode conductor between the ground bus and the grounding electrode system.
 - 1. In rigid PVC conduit.
 - 2. Provide thermo fusion connection for each rod ground electrode.
 - a. All rod electrodes shall be located outside the building in non-paved areas where available. Access cover top shall be flush with finish grade or floor.
 - b. Install rod electrodes as indicated. Install additional rod electrodes as required to achieve specified resistance to ground.
 - c. The minimum distance between driven ground rod electrodes shall be 10'.
 - 3. The total ground resistance shall not exceed 10 Ohms for service entrance grounds and for equipment grounds.
 - a. Where this condition cannot be obtained with one electrode, install a longer electrode, deep-driven sectional electrodes, or additional grounding electrodes until the required ground resistance is obtained.
 - b. Refer to drawings for project specific ground resistance requirements.
- C. Field verify the grounding electrode conductor between the ground bus and the grounding electrode systems are in compliance with the NEC.
- D. Provide an insulated grounding conductor inside all new conduits, raceways, surface raceways and cables used for power distribution. The ground wire shall be bonded to each box. All bonding jumpers shall be routed inside conduit or raceway.
- E. Provide an insulated, isolated equipment grounding conductor in addition to the insulated equipment grounding conductor for all isolated grounding feeders, branch circuits, outlets and receptacles.
- F. Provide all new/relocated conduits terminating in switchgear, transformers, switchboards, and panelboards with grounding bushings, where required and ground wire extended to ground bus in equipment.
- G. Where modifications to the main service disconnect are required, main bus and building grounding electrode conductor installation shall be witnessed by the Architect / Engineer.
- H. Interface with lightning protection system when lightning protection system is specified.
- I. Locate and install anchors, fasteners, and supports in accordance with NECA "Standard of Installation".
- J. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- K. Do not use spring steel clips and clamps.
- L. Do not use powder-actuated anchors.
- M. Do not drill or cut structural members.
- N. Do not use compression or mechanical connectors underground.

3.2 SYSTEMS OVER 600 VOLTS

- A. Provide insulated grounding bushings at each new/relocated conduit termination. The grounding system shall be made continuous with bare copper jumpers.
 - 1. Connect the copper grounding jumpers to the ground bus in the equipment.
- B. Install a grounding conductor in each conduit.
 - 1. 600 V code gauge Type XHHW.
 - 2. Green insulation.
- C. Connect the grounding conductor to:
 - 1. Each new/relocated/reused splice or pull box enclosure.
 - 2. Each new/relocated/reused transformer enclosure.
 - 3. All new/relocated/reused primary switchgear enclosures.

3.3 MISCELLANEOUS REQUIREMENTS

- A. Continuity of the building equipment grounding system shall be maintained throughout the project. Grounding jumpers shall be inside conduit, fittings and boxes and shall be installed across conduit expansion fittings, liquid-tight flexible metal and flexible metal conduit, light fixture pigtails in excess of 6', and other non-electrically continuous raceway fittings.
- B. Grounding conductors and grounding electrode conductor shall be stranded copper conductors and run in a suitable PVC raceway. Grounding conductors and grounding electrode conductor shall be continuous, without joints or splices over their entire length, except as allowed by NFPA 70/NEC.
- C. For separately derived alternating current system grounds, bond the case and neutral of each transformer secondary winding directly to the nearest available effectively grounded structural metal member as required in NEC 250.
- D. Technology/Data/Voice Communications, CATV, CCTV, and MATV Equipment Grounding: Provide grounding electrode conductor from the communications service equipment to the building grounding system as required. Provide #6 ground conductor from telephone/voice/CATV/data company demarcation point to building electrical service entrance ground electrode connection and as required by all local utility companies.
 - 1. New MDF Closets Telecommunications Main Ground Bar (TMGB): Provide Erico Cadweld #B544A028 ground bar with 7/16-inch holes, wall mounted to the telecommunications plywood backboard. Provide one #3 AWG insulated ground conductor from ground bar to building steel. Provide #2/0 AWG insulated ground conductor to the building electrical service ground at the main electrical service disconnect.
 - 2. New IDF Closets Telecommunications Ground Bar (TGB): Provide Erico Cadweld #B542A004 ground bar with 7/16-inch holes, mounted to the telecommunications plywood backboard. Provide one #6 AWG insulated ground conductor from ground bar to building steel.
 - 3. Provide #2/0 AWG insulated ground conductor between each TMGB and all TGBs.
 - 4. Provide #2/0 AWG insulated ground conductor from TMGB to electrical service ground bus at main electrical service switch.
 - 5. Bond each equipment rack with #6 AWG insulated ground conductor to the TMGB / TGB.
 - 6. Route TMGB – TGB ground conductor using the shortest route practical with long radius curves.
- E. Ground new and removed/replaced lighting fixture bodies to the conduit grounding system.
- F. Receptacles: Provide a ground wire bonded to the conduit ground system, except where and insulated isolated grounding receptacle is specified.
- G. Motor Frames: Ground the frame of each motor with a properly sized separate ground wire around flexible conduit.
- H. Provide grounding access well for each driven ground electrode, not located in manholes or pull boxes.
 - 1. Access well top shall be flush with finish paved surfaces.
 - 2. Ground access wells located in non-paved areas shall be set two-inches above surrounding finished grade. Provide 12-inch wide by 8-inch deep reinforced concrete crown around neck or opening and sloped down away from pull box opening.
 - 3. Provide thermal fusion (exothermic) connectors approved for direct burial.
- I. Ground all light poles and all exterior metal structures supporting conduit, switchgear, or light fixtures.
- J. Exterior Electrical Equipment Racks:

1. Provide driven ground electrode for racks mounted remote from building structure.
 2. Where mounted on roof, ground to be building structural steel.
- K. Ground connections to building steel, grounding electrodes and all underground connections shall be by thermal fusion (exothermic).
- L. Transformers: Provide driven ground electrode and building steel electrode at each transformer.
- M. Bond hot water and cold water piping together at each domestic water heater.

3.4 COORDINATION

- A. General: Coordinate installation of grounding connections for equipment with equipment installation work.

3.5 TESTING

- A. Ground Resistance Test: Perform a ground resistance test for comparison to future inspection and testing data by the Owner. Test shall be performed using a Biddle Megger Earth Tester or equivalent test instrument. The test shall not be performed within 48 hours after the last rainfall.
1. Inspect and test in accordance with NETA ATS except Section 4
 2. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13
- B. The Root Mean Square (RMS) AC measurements: The True RMS AC Measure test should be performed for all bonding conductors. The recommended maximum AC current value on any bonding conductor should be less than 1 ampere (A). The recommended maximum DC current value should be less than 500 milliamperes (mA). If abnormally high AC current levels are present on any bonding conductor, a dangerous faulty wiring condition likely exists within the room.
- C. Two-Point Bonding Measurements: The two-Point Bonding test shall be performed for all bonding conductors. This test should be performed using an earth grounding resistance tester configured for a continuity test. The test is performed by connecting the meter leads between the nearest available grounding electrode (e.g., structural steel) and the TMGB or TGB. The recommended maximum value for the bonding resistance between these two points is 0.1 ohms (100 milliohms).
- D. Submittals: Furnish instruments and personnel required for tests. Personnel shall be trained in all aspects of testing grounding systems and shall be formally trained on using all test equipment required. Submit 2 copies of certified test results for Owner's record and submit 4 copies of certified test results to Architect / Engineer for review. Test reports shall include date and time of tests, relative humidity, temperature, and weather conditions.

END OF SECTION

**SECTION 26 0533
CONDUIT SYSTEMS**

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Furnish and install a complete system of electrical conduits and fittings.

1.2 REFERENCE STANDARDS

- A. National Electrical Code
B. Local codes and ordinances
C. UL
D. ETL

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS – Provide products manufactured in the USA

- A. Raceways:
1. Allied, International Metal Hose, Ipex, Heritage Plastics, Wheatland, Can-Tex, Carlon, Certain-Teed, Anamet, Inc., Electri-Flex Co., Western Tube and Conduit.
2. PVC Coated RGC: Robroy Perma Cote, Robroy Plasti-Bond, or Calbond – no exceptions
3. Stainless Steel: Robroy, Calbrite, Gibson
4. Aluminum: Penn Aluminum, American Conduit, Wheatland, Eaton B-Line, Patriot Aluminum Products
B. Fittings:
1. Appleton, Crouse Hinds, Topaz, Steel City, O.Z. Gedney, Carlon, Heritage Plastics, Raco, Ipex, International Metal Hose, Lew Electric Fittings Co.
2. PVC Coated ferrous fittings: Robroy Perma Cote, Robroy Plasti-Bond, or Calbond – no exceptions
3. Stainless Steel: Robroy, Calbrite, Gibson, Crouse Hinds
4. Aluminum: Penn Aluminum, American Conduit, Wheatland, Eaton B-Line, Patriot Aluminum Products
C. Condulets and Conduit Bodies:
1. Appleton, Form 85
2. PVC Coated: Robroy Perma-cote or Plasti-Bond, – no exceptions
3. Stainless Steel: Robroy, Calbrite, Gibson, Crouse Hinds
D. Steel MC Cable for light fixture whips:
1. AFC
2. Southwire
3. General Cable
4. Kaf-Tech

2.2 GENERAL

- A. The minimum conduit size shall be ¾-inch unless indicated otherwise in Divisions 26, 27 or 28.
1. Branch Circuits: Minimum conduit size shall be ¾-inch.
2. Feeder Circuits: Minimum conduit size shall be ¾-inches.
3. Technology, telecommunications, and low voltage systems: The minimum conduit size shall be ¾-inches unless noted or indicated otherwise.
4. The minimum conduit size between buildings for technology, voice, data, fire alarm, video, security, surveillance, BMCS, and other telecommunications shall be 2-inch unless indicated otherwise.

- B. The minimum conduit size for flexible metallic conduit for tap connections to individual light fixtures shall be ½ inch, or steel metal clad (MC) cable with insulated ground conductor maximum 6 feet.
- C. Electrical nonmetallic tubing, flexible polyethylene or PVC tubing shall not be used on this project.
- D. BX and AC cable shall not be used on this project.
- E. PVC elbows shall not be used on this project.
- F. Intermediate metal conduit (IMC) shall not be used on this project.

2.3 RIGID METAL CONDUIT

- A. UL labeled, Schedule 40:
 - 1. Mild steel pipe, zinc coated inside and out
 - 2. Aluminum Alloy 6063, T-1 temper
 - 3. Threaded ends
 - 4. Insulated bushings
- B. Fittings shall meet the same requirements as rigid metal conduits.
 - 1. UL labeled
 - 2. Threaded fittings

2.4 ELECTRICAL METALLIC TUBING (EMT)

- A. UL labeled, standard weight:
 - 1. Cold rolled steel tubing, zinc coated inside and out
 - 2. Aluminum Alloy 6005, 6063. Temper T-1
- B. Fittings shall meet the same requirements as EMT conduits.
 - 1. UL labeled
 - 2. Insulated throat connectors
 - 3. Steel fittings with setscrews with lock nuts on threaded ends, no snap locks
 - 4. Cast metal fittings are not approved
 - 5. Uni-couple type connectors are not approved
 - 6. Split ring, anti-short bushings are not approved

2.5 PVC COATED RIGID STEEL WITH URETHANE INTERIOR COATING

- A. The PVC coated galvanized rigid conduit and fittings must be ETL Listed and Verified. The PVC coating must have been investigated and verified by ETL as providing the primary corrosion protection for the rigid metal conduit. Ferrous fittings for general service locations must be ETL Listed with PVC as the primary corrosion protection. Hazardous location fittings, prior to plastic coating must be UL listed for the hazard conditions to which they are to be used. All conduit and fittings must be new, unused material. Applicable UL standards may include UL 6 Standard for Safety, Rigid Metal Conduit, and UL514B Standard for Safety, Fittings for Conduit and Outlet Boxes.
- B. The PVC coated galvanized rigid conduit and fittings must be ETL Verified to the Intertek ETL SEMKO High Temperature H₂O PVC Coating Adhesion Test Procedure for 200 hours. The PVC coated galvanized rigid conduit must bear the ETL Verified PVC-001 label to signify compliance to the adhesion performance standard.
- C. The conduit shall be hot dip galvanized inside and out with hot galvanized threads.
- D. A PVC sleeve extending one pipe diameter or two inches, whichever is less, shall be formed at every female fitting opening except unions. The inside sleeve diameter shall be matched to the outside diameter of the conduit.
- E. The PVC coating on the outside of conduit couplings shall have a series of longitudinal ribs 40 mils in thickness to protect the coating from tool damage during installation.
- F. Form 8 Condulets, ½-inch through 2-inch diameters, shall have a tongue-in-groove gasket to effectively seal against the elements. The design shall be equipped with a

- positive placement feature to ease and assure proper installation. Certified results confirming seal performance at 15 psig (positive) and 25 inches of mercury (vacuum) for 72 hours shall be available.
- G. Form 8 Condulets shall be supplied with plastic encapsulated stainless-steel cover screws.
 - H. A urethane coating shall be uniformly and consistently applied to the interior of all conduit and fittings. This internal coating shall be a nominal 2 mil thickness. Conduit or fittings having areas with thin or no coating shall be unacceptable.
 - I. The PVC exterior and urethane interior coatings applied to the conduit shall afford sufficient flexibility to permit field bending without cracking or flaking at temperatures above 30°F (-1°C).
 - J. All male threads on conduit, elbows and nipples shall be protected by application of a urethane coating.
 - K. All female threads on fittings or conduit couplings shall be protected by application of a urethane coating.
 - L. Independent certified test results shall be available to confirm coating adhesion under the following conditions
 - 1. Conduit and conduit exposure to 150°F (65°C) and 95% relative humidity with a minimum mean time to failure of 30 days. (ASTM D1151)
 - 2. The interior coating bond shall be confirmed using the Standard Method of Adhesion by Tape Test (ASTM D3359).
 - 3. No trace of the internal coating shall be visible on a white cloth following six wipes over the coating which has been wetted with acetone (ASTM D1308).
 - 4. The exterior coating bond shall be confirmed using the methods described in Section 3.8, NEMA RN1. After these tests the physical properties of the exterior coating shall exceed the minimum requirements specified in Table 3.1, NEMA RN1.
 - M. Right angle beam clamps and U bolts shall be specially formed and sized to snugly fit the outside diameter of the coated conduit. All U bolts shall be provided with plastic encapsulated nuts that cover the exposed portions of the threads.
 - N. All fittings, clamps, straps, struts, and hardware used with PVC coated conduit shall be PVC coated or 316 stainless steel

2.6 STEEL FLEXIBLE CONDUIT

- A. Steel flexible metallic conduit:
 - 1. Zinc coated inside and out
 - 2. 18-inches minimum length, 24-inches maximum length
- B. Steel flexible metallic conduit for tap connections to light fixtures where steel MC Cable fixture whips are not used:
 - 1. 18 inches minimum length; 6 feet maximum length
- C. Liquid tight flexible steel conduit
 - 1. Type L.A. - Grounded - UL Approved
 - 2. 18-inches minimum length, 24-inches maximum length

2.7 PVC CONDUIT

- A. UL labeled Schedule 40 and Schedule 80
- B. PVC fittings and solvent welded joints
- C. Acceptable PVC conduit manufacturer: Ipex, Cantex

2.8 CONDULETS AND CONDUIT BODIES

- A. UL Labeled
- B. Form 85

- C. PVC Coated: Form 8
- D. LBC Condulets shall be used for size 2 inch and above.
- E. LL and LR Condulets shall not be used for 2 inch and above

2.9 ROOF MOUNTED CONDUIT AND BOX SUPPORTS

- A. Conduit supports and pads suitable for direct sunlight, conduit size, weight, quantity and roof system with unistrut supports and accessories. Conduit supports shall allow for conduit expansion and contraction.
- B. Refer to roofing specifications for additional information. The limitations and restrictions contained in any roofing specification shall prevail and supercede these specifications for roof mounted supports for conduits and boxes.
- C. Approved Manufacturer:
 - 1. Portable Pipe Hangers
 - 2. Eaton B-Line
 - 3. Miro Industries, Inc.

2.10 ALUMINUM CONDUIT

- A. UL Labeled
- B. Aluminum fittings shall meet the same requirements of aluminum conduits, compatible steel fittings.
 - 1. UL Labeled for use with aluminum conduit.

2.11 STAINLESS STEEL CONDUIT

- A. UL Labeled
- B. Rigid Stainless Steel:
 - 1. Type 304 Stainless Steel
 - 2. Threaded ends
 - 3. Insulated Bushings
- C. EMT:
 - 1. Type 304 Stainless Steel
 - 2. Compression Fittings
 - 3. Insulated Bushings
- D. Fittings, elbows, nipples, strut, device box, clamps straps, etc.
 - 1. Type 304 Stainless Steel

2.12 EXTERIOR IN-GRADE PULL BOXES

- A. Enclosures, boxes and covers are required to conform to all test provisions of the most current American Association of State Highway and Transportation Officials (AASHTO) standards for H-20 loading applications.
 - 1. AASHTO H-20 certified precast concrete, cast iron or other AASHTO recognized materials, rated for deliberate traffic.
 - 2. Conduit entry knock-outs as required
 - 3. Bolt down galvanized steel/cast iron covers
 - 4. Thin wall knocks outs as required
 - 4. Integral bottom
 - 5. Box height as required for specified conduit depth and required top elevation.
 - 6. Concrete design strength of minimum 5,500 PSI at 28-days
 - 7. Place enclosures on a minimum of 6 inches of coarse gravel with a border of 6-inches beyond the enclosures exterior dimension.
 - 8. Size and volume as required for application.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install electrical conduits and fittings for all wiring of any type unless specifically specified or instructed to do otherwise. Install conduits and fittings in accordance with local codes and applicable sections of the NECA “Standard of Installation”, concealed where possible.
 - 1. Fasten conduit supports to building structure and surfaces; do not support to roof deck.
 - 2. Arrange supports to prevent misalignment during wiring installation.
 - 3. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
 - 4. Do not attach conduit to ceiling support wires.
 - 5. Arrange conduit to maintain head room and present neat appearance.
 - 6. Maintain 4-inch clearance between conduit and rooftop surfaces.
 - 7. Cut conduit square using saw or pipe cutter; de-burr cut ends.
 - 8. Bring conduit to shoulder of fittings; fasten securely.
 - 9. Conduit penetrations to all individual motor controllers, VFDs, and motor control cabinets shall only be made at the bottom of the enclosure. For other equipment, provide listed water sealing conduit hubs to fasten conduit to sides or tops of electrical equipment enclosures, device box, gutter, wireway, disconnect, etc.
 - 10. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
 - 11. Ground and bond conduit as required.
 - 12. Identify conduit as required.
 - 13. Route all conduits above building slab perpendicular or parallel to building lines.
 - 14. Do not use no-thread couplings and connectors for galvanized steel, PVC coated galvanized steel, or aluminum rigid conduit.
- B. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.
- C. In areas where raceway systems are exposed and acoustical or thermal insulating material is to be installed on walls, partitions, and ceilings, raceways shall be blocked out proper distance to allow insulating material to pass without cutting or fitting. Also provide Kindorf galvanized steel channels to serve as standoffs for panels, cabinets and gutters.
- D. Securely fasten conduits, supports and boxes, to ceiling (not roof deck), walls, with Rawl Plugs or approved equal anchors. Use lead cinch anchors or pressed anchors. Use only cadmium plated or galvanized bolts, screws. Plastic anchors and lead anchors shall not be used for overhead applications.
- E. Provide separate raceway systems for each of the following when specified, indicated or required:
 - 1. 120/208 volt circuits
 - 2. 277/480 volt circuits
 - 3. Emergency
 - a. Life safety branch
 - b. Critical branch
 - c. Equipment branch
 - 4. Voice/Data
 - 5. Sound reinforcement
 - 6. Theatrical and Architectural Dimming Controls
 - 7. MATV/CATV
 - 8. Security CCTV
 - 9. Security System
 - 10. Communications / PA Systems / Sound System Line Input and Speakers
 - 11. Fire Alarm

12. Lighting and Building Management Control Systems
- F. Unless shown otherwise, do not install conduit in or below concrete building slabs.
- G. Unless shown otherwise, do not install conduit horizontally in concrete slabs.
- H. Roof penetrations shall be made in adequate time to allow the roofing installer to make proper flashing. Conduit for equipment mounted on roof curbs shall be routed through the roof curb. Conduit, gutters, pull boxes, junction boxes, etc. shall not be routed on roof unless specified otherwise. Where specifically indicated to be routed or mounted on the roof, supports shall be as specified, as recommended by roofing manufacturer and roof support manufacturer and as required by NEC. Place supports every five feet along conduit run and within 3 feet of all bends, condulets, and junction boxes. Provide roofing pad under stands as directed by Architect and as recommended by roofing manufacturer and roof support manufacturer. Provide additional unistrut supports and accessories as required.
- I. PVC coated conduit shall have all nicks and cuts to the protective coating repaired using manufacturer's approved touch-up material as recommended by manufacturer. Provide a minimum of two-wraps of 3M-50 type tape over touch-up.
- J. Installation of the PVC Coated Conduit System shall be performed in accordance with the Manufacturer's Installation Manual. To assure correct installation, the installer shall be certified by Manufacturer to install coated conduit. Submit copies of training certification with submittal. Contractor shall coordinate installation with manufacturer's representative for field training and observation of installed PVC coated rigid galvanized conduit and fittings. Manufacturer's representative shall certify the installation is in accordance with manufacturer's installation instructions. Submit copies of installation certification prior to cover-up of underground installation.
- K. All conduit terminations at locations including but not limited to, switchgear, pull boxes, outlet boxes, stub-up, and stub-outs:
1. Provide insulated throat connectors for EMT conduits.
 2. Provide insulated bushing on all rigid conduit terminations.
 3. Provide locknuts inside and outside of all boxes and enclosures.
 4. Provide threaded type plastic bushing at all boxes and enclosures
- L. In suspended ceilings, support conduit runs from the structure, not the ceiling system construction.
1. Do not support from structural bridging.
 2. Do not support from metal roof deck.
- M. Completely install each conduit run and all bushings prior to pulling conductors. All boxes are to be accessible after completion of construction.
- N. All conduits must be kept dry and free of water or debris with approved pipe plugs or caps. Cap or plug conduit ends prior to concrete pouring.
- O. Ream ends of conduits after cutting and application of cutting die to remove rough edges.
- P. Install all above concrete slab conduits perpendicular or parallel to building lines in the most direct, neat and workmanlike manner.
1. Cable Tension:
 - a. 0.008 lb./cmil for up to 3 conductors, not to exceed 10,000 pounds.
 - b. 0.0064 lb./cmil for more than 3 conductors, not to exceed 10,000 pounds
 - c. 1000 lbs. per basket grip.
 2. Sidewall pressure: 500 lbs./ft.
 3. Conduit runs within the following limits of bends and conduit length between pull points shall not exceed the above installation pulling tension and sidewall pressure limits.
 - a. Three (3) equivalent 90-degree bends: not more than fifty feet (50') between pull points.
 - b. Two (2) equivalent 90-degree bends: not more than one hundred feet

- (100') between pull points.
 - c. One (1) equivalent 90-degree bend: not more than one hundred fifty feet (150') between pull points.
 - d. Straight pull: not more than two hundred feet (200') between pull points.
 - 4. Indicate sizes of conduits, wireway sections, and cable tray sections on the as-built drawings.
 - 5. Hold horizontal and vertical conduits as close as possible to walls, ceilings and other elements of the building construction. Conduits shall be kept a minimum of 6 inches clear of roof deck / insulation, and 2 inches clear of above floor deck / insulation.
 - 6. Install conduits to conserve building space and not obstruct equipment service space or interfere with use of space. Conduit shall not be routed on floors, paved areas or grade.
 - 7. Where a piece of equipment is wired from a switch or box on adjacent wall, the wiring shall go up the wall from the box, across at or near the ceiling, and back down to the equipment. Wiring shall not block the walkway between wall and equipment.
 - 8. Horizontal runs of conduit on exposed walls shall be kept to a minimum.
 - 9. Conduit for mechanical / plumbing equipment installed outdoors shall be routed with the associated mechanical / plumbing pipe support rack system where practical, coordinate with Divisions 22 and 23.
 - 10. Conduits installed in public areas, not concealed by architectural ceilings, shall be supported by galvanized steel channel racks to bottom of roof deck or floor deck. Conduits shall be grouped for neat workman-like appearance.
- Q. Install expansion and deflection fittings and bonding jumpers on straight runs which exceed 200-feet, on center, and at 200-feet maximum, on center, on straight runs which exceed 400-feet, and where conduits cross building expansion joints.
- R. Provide grounding bushings at concentric/eccentric knockouts or where reducing washers are used.
- S. Run conduit to avoid proximity to heat producing equipment, piping surfaces with temperatures exceeding 104 degrees F., and flues, keeping a minimum of 13-inches clear.
- T. Install conduit as a complete system, without conductors, continuous from outlet to outlet and from fitting to fitting. Make up threaded joints of conduit carefully in a manner to ensure a tight joint. Fasten the entire conduit system into position. A run of conduit between outlet and outlet, between fitting and fitting, or between outlet and fitting shall not contain more than the equivalent of four quarter bends, including those bends located immediately at the outlet or fitting.
- U. Conceal conduit systems in finished areas. Conduit may be exposed in mechanical and electrical rooms, and where otherwise shown or indicated only. Run the conduit parallel and perpendicular to the structural features of the building and support with malleable iron conduit clamps at intervals as required by NEC or on conduit racks, neatly racked and bent in a smooth radius at corners.
- V. Conduit bends shall be factory elbows or shall be bent using equipment specifically designed to bend conduit of the type used to maintain the conduit's UL listing. Conduit hanger spacing shall be 10 feet or less and as required by the NEC for all conduit. Beam clamp attachments to steel joist chords is prohibited. Beam clamps may only be used at beams, no exceptions. Connections to joists shall be made with galvanized channel extended between joist chords or with galvanized channel bearing on the vertical legs of joist chord angles.
- W. Support conduit on galvanized channel, using compatible galvanized fittings (bolts, beam

clamps, and similar items), and galvanized threaded rod pendants at each end of channel and secure raceway to channel and channel to structure. Where rod pendants are not used, channel supports are to be secured to structure at each end. Conduit supports are to be secured to structure using washers, lock washers, nuts and bolts or rod pendants; use of toggle bolt “wings” are not acceptable. Support single conduit runs using a properly sized galvanized conduit hanger with galvanized closure bolt and nut and threaded rod. Raceway support system materials shall be galvanized and manufactured by Kindorf, Unistrut, Superstrut, Caddy, or Spring Steel Fasteners, Inc. Provide chrome or nickel-plated escutcheon plates on conduit passing through walls and ceilings in finished areas. Do not support conduit from other conduit, structural bridging or fire rated ceiling system. Do not support more than one conduit from a single all-thread rod support. Provide electrical insulating sleeve or wrapping for aluminum conduit supported by zinc coated supports or fasteners. Channel supports shall have cut ends filed smooth. When installed outside of the building, or in areas subject to moisture, the cut ends shall be painted with ZRC galvanized paint or equivalent.

- X. Terminate all motor connection conduits in mechanical room spaces with a floor pedestal and with “Tee” conduit at motor outlet height for flexible conduit.
- Y. Where conduit is not embedded in concrete or masonry, conduit shall be firmly secured by approved clamps, half-straps or hangers. Tie wire and short pieces of conduit used as supports and or hangers are not approved.
- Z. Where “LB” condulets are used, 2-inches and larger shall be type “LBD”.
- AA. No more than 12 conduits containing branch circuits may be installed in junction boxes, pull boxes or gutters.
- BB. Flexible metal conduit and liquid tight flexible metal conduit shall only be used for final connections from junction box to the following: motorized equipment, transformers, interior light fixtures above ceilings, and power poles. They shall not be used in lieu of rigid conduit runs. They shall not be used for wall or roof penetrations except for exterior building mounted light fixtures and installed in a PVC coated RGC conduit sleeve at least one size larger than the OD of the flexible conduit.
- CC. Where 3-1/2-inch conduit is specified and the required or specified material is Schedule 80 PVC, provide 4-inch conduit.
- DD. “Daisy Chaining” light fixtures installed for lay-in ceiling areas is not allowed. Each light fixture shall have its own fixture whip from junction box. The only exception being light fixtures installed end to end using chase nipples between them, or light fixtures recessed in non-accessible ceilings.
- EE. In above ceiling applications, do not install raceways, junction boxes, gutters, disconnects, etc. within 36 inches directly in front of HVAC control boxes or other equipment requiring access from a point starting from the top of control box / equipment down to ceiling.
- FF. Do not install conduit, junction boxes, etc. within 18 inches of outside edges of roof access openings.
- GG. Install minimum size 2-inch nipple, at least one, between multi-sectional panels for branch circuit independent of feeder conductors.

3.2 CONDUITS

- A. Conduit above grade indoors:
 - 1. Concealed Conduits: EMT with steel set screw fittings
 - 2. Exposed conduits:
 - a. Below nine feet AFF where not directly attached and against building walls, ceiling, or structure: Rigid metal conduit.
 - b. Where subject to physical damage: Rigid metal conduit.
 - c. Wet locations: PVC coated galvanized rigid steel or aluminum conduit

- d. Damp Locations: Aluminum rigid conduit.
 - e. Exposed conduits in mechanical rooms or electrical rooms shall be rigid galvanized steel when installed below 18-inches above finished floor.
 - B. Conduit installed above grade outdoors:
 - 1. Galvanized rigid steel for conduits up utility poles and where subject to physical damage or where located less than four feet above finished floor.
 - 2. Aluminum where not subject to physical damage and where located four feet above finished floor.
 - C. Conduit where indicated underground:
 - 1. PVC Coated Galvanized rigid steel conduit elbows and Schedule 80 PVC, or PVC coated galvanized steel straight run conduits. PVC conduits for underground branch circuits shall be Schedule 80 or Schedule 40 PVC.
 - a. PVC conduit and fittings shall be used only for straight horizontal runs and for vertical risers at site lighting pole bases. Bending straight sections of PVC conduit to less than 25-foot radius or the use of PVC factory bends is not allowed.
 - b. Change in direction of conduit runs, either vertical or horizontal, shall be with PVC coated galvanized steel elbows or long sweep bends of straight PVC conduit sections. Long sweep bends of straight PVC 20-foot sections shall have a minimum radius of curvature of 25 feet and a maximum arc of 22.5degrees. Multiple long sweep bends of straight PVC sections shall be separated by a minimum of 20-feet of straight, linear, PVC sections.
 - c. Provide PVC coated rigid galvanized steel conduit elbows and fittings with urethane interior coating at all changes in direction with radius of less than 25-feet and at all vertical runs to 18 inches above finished floor elevation. For interior slab penetrations, provide continuous PVC coated rigid galvanized steel conduit and fittings with urethane interior coating from change in direction to 18 inches above finished floor elevation, except where stubbed-up under and inside equipment or switchgear where conduit shall be terminated at minimum two inches above concrete housekeeping pad.
 - d. Elbows for underground electrical service entrance, feeders, transformer primary / secondary, telecommunication, and low voltage conduits shall be PVC coated rigid galvanized steel with long radius as follows:
 - 1) Up to 1-inch conduit, minimum 12-inch radius.
 - 2) 1.5-inch conduit, minimum 18-inch radius.
 - 3) 2-inch conduit, minimum 24-inch radius.
 - 4) 2.5-inch conduit, minimum 30-inch radius.
 - 5) 3-inch conduit, minimum 36-inch radius.
 - 6) 3.5 to 6-inch conduit, minimum 48-inch radius.
 - e. Conduit for all floor boxes shall be routed below building slab from floor box to nearest column, wall, or as indicated.
 - f. Conduits shall not be routed horizontally in building slab, grade beams or pavement.
 - 2. Underground conduits:
 - a. Concrete encasement for utility installed conductors shall be as specified by the utility and comply with their standards and specifications.
 - c. Provide conduit spacers for parallel branch/feeder conduits.
 - d. Conduits either specified or approved in writing to be routed under building slab for electrical branch circuits or voice / data / video / communications horizontal drops or outlets shall be installed 18 inches

- below finished floor and on select fill. All other conduits, including but not limited to electrical feeders, voice / data / video / communications vertical, riser, tie, trunk, or service cable conduits shall be installed 48-inches below finished floor and on select fill.
- e. Use suitable manufactured separators and chairs installed 4 feet on centers. Securely anchor conduit at each chair to prevent movement during backfill placement.
- 3. Install building voice / data / video / communications main service conduits and electrical service transformer primary and secondary conduits with top of conduit 48-inches below finished grade or pavement. Voice / data / video / communications conduits and electrical service primary conduits for utility owned electrical service transformers shall also comply with the respective utility company requirements and standards. All other underground conduits outside of building other than voice / data / video / communications main service conduits and electrical service transformer primary and secondary conduits shall have top of conduit at 36 inches minimum below finished grade or pavement.
 - 4. Provide two “caution” plastic tapes at 6-inches and 18-inches below finished slab, grade, or pavement; identify as specified in Section 26 05 00.
 - 5. Conduits located outside the building, provide magnetic locator tape at top of first compacted layer of backfill.
 - 6. During construction, partially completed underground conduits shall be protected from the entrance of debris such as mud, sand, and dirt by means of conduit plugs. As each section of the underground conduit is completed, a testing mandrel with diameter ¼-inch smaller than the conduit, shall be drawn through each conduit. A brush with stiff bristles shall be drawn through until conduit is clear of particles of earth, sand, or gravel. Conduit plugs shall then be installed.
 - 7. Utility underground conduit for Utility Company cable shall be installed per Utility Company standards, and their specifications for this project.
 - 8. Concrete shall be Portland Cement conforming to ASTM-C-150, Type 1, Type III or Type V if specified. Cement content shall be sufficient to product a minimum strength of 2,500 PSI.
 - 9. Contractor shall stake out routing and location of underground conduits using actual field measurements. He shall obtain approval of the Owner and Architect before beginning trenching, horizontal drilling, and excavation.
 - 10. Verify location and routing of all new and existing underground utilities with the Owner and Architect on the job site. Stake out these existing utilities so that they will not be damaged. Stake out new utilities to provide coordination with other trades and with new and existing utilities, easements, property lines, restricted land use areas, and right-of-ways. Verify existing public utilities with Call811.
- D. Conduit shown in concrete walls, floor or roof slab:
 - 1. PVC Coated Galvanized Rigid steel.
 - E. Conduits that penetrate concrete slabs, or within 100 feet of cooling towers, or at designated corrosive locations.
 - 1. PVC coated galvanized rigid steel
 - F. Connections to motorized equipment mounted on roof, rotating equipment, transformers, and kitchen or food processing equipment, or where flexible conduit is required outdoors.
 - 1. Liquid tight flexible metal conduit (1/2 inch may be used for roof top supply / exhaust fans only)
 - 2. Liquid tight flexible metal conduit length shall be between 18 and 24 inches
 - 3. Conduit for roof-mounted equipment shall be routed inside the roof curb assembly roof opening. Provide permanent lock-off device at panelboard circuit breakers serving roof equipment and accessories to enable tag-out procedures

- for all power routed through roof curb and to the roof mounted equipment and accessories.
- G. Light fixture whips:
1. Accessible ceilings and open structure: ½-inch flexible steel conduit or steel MC cable, length not to exceed 6-feet.
 2. Non-accessible ceilings: ½-inch flexible steel conduit. Length as required to make a tap at an accessible j-box. Recessed light fixtures in non-accessible ceilings may be daisy chained using the light fixture's integral, UL listed j-box or internal wire way that is accessible through fixture from below the ceiling.
 3. Dedicated insulated ground wire.
 4. Light fixture whips shall not rest on ceiling grid or tile.
 5. Light fixture whips shall not be supported from the ceiling suspension system. Support from the structure with #13 AWG galvanized iron wire pendants and Caddy clips. Do not support conduit from structural bridging. Flexible conduit and steel MC cable shall be kept a minimum of 2 inches clear of roof deck.
- H. Conduits at Natatorium or therapeutic pool areas:
1. Underground conduit shall be as specified in this section.
 2. Exterior conduits and boxes within 100 feet of exhaust openings shall be PVC coated galvanized rigid steel or stainless steel.
 3. Exposed conduits in chemical storage rooms, pool mechanical equipment (pump rooms, and pool equipment storage rooms shall be Schedule 80 PVC. Boxes shall be PVC, or 304 Stainless Steel.
 4. Exposed conduits and boxes in indoor pool areas and all other indoor public areas shall be Type 304 Stainless Steel.
- I. Conduits located inside greenhouses and natatorium pump and water treatment rooms:
1. Schedule 80 PVC
 2. PVC coated galvanized rigid steel conduit and fittings.

3.3 CONDUIT PENETRATIONS, SLEEVES AND ESCUTCHEONS

- A. Furnish sleeves for placing in construction for all conduit passing through concrete or masonry walls, partitions, beams, all floors other than grade level, and roofs. A conduit sleeve shall be one size larger than the size of conduit, which it serves except where larger sizes are required for manufactured water, fire, or smoke stop fittings.
1. Sleeves set in concrete floor construction shall be minimum Schedule 40 galvanized steel.
 2. Sleeves shall extend 3-inches above the finished floor.
- B. Sleeves in concrete or masonry walls shall be Schedule 40 galvanized steel. Sleeves shall be set flush with finished wall.
- C. Install manufactured UL listed water, fire, and smoke stop fittings, or caulk around conduit or cables in sleeves with sufficient UL listed fire safe insulation or foam to maintain wall or floor slab fire or smoke rating. Refer to Architecture drawings for locations of rated walls.
- D. Provide Linkseal Mechanical Seals around conduit penetrations through walls below grade. Provide a pull box to install a water stop inside wall penetration. Internally seal low voltage cabling conduit penetrations with waterproof caulking.
- E. Sleeves penetrating walls below grade shall be Schedule 40 black steel pipe with ¼-inch thick steel plate secured to the pipe with continuous fillet weld. The plate shall be located in the middle of the wall and shall be 2-inches wider all around than the sleeve that it encircles. The sleeve should extend a minimum of 24-inches on either side of the penetration. The entire assembly shall be hot-dipped galvanized after fabrication. Do not sleeve or penetrate grade beams.
- F. Conduit passing through the housing on connected equipment shall pass through a

cleanly cut hole protected with a threaded steel bushing. Route conduit through roof openings, for piping and ductwork or through suitable roof jack, with pitch pocket. Coordinate location with roofing installation as required.

- G. Conduit passing through fire rated wall shall be sealed with Fire Stop. Route conduit to preserve fire resistance rating of partitions and other elements, using materials and methods under the provisions of Division 7.

3.4 POWER DISTRIBUTION UNDERGROUND FEEDER CONDUIT AND UNDERGROUND SERVICE ENTRANCE CONDUIT

- A. Power underground feeder and service entrance shall be of individual conduit. Unless shown otherwise, the type of conduit used shall not be mixed in any one underground conduit and shall be the size indicated on the drawings. Conduit for 120V and above shall be separated from control and signal conduits by a minimum of 3-inches.
- B. During construction, partially completed underground conduits shall be protected from the entrance of debris such as mud, sand, and dirt by means of conduit plugs. As each section of the underground conduit is completed, a testing mandrel shall be drawn through until each conduit is clear of particles of earth, sand, or gravel. Conduit plugs shall then be installed.
- D. Conduit for service entrance underground conduits shall be as indicated on the drawings.
- E. Primary power underground conduit shall be installed in accordance with utility company standards and the utility company specifications for this project.

3.5 TELECOMMUNICATIONS, LOW VOLTAGE AND EMPTY CONDUIT SYSTEM RACEWAYS

- A. Conduit shall be installed in accordance with the specified requirements for conduit and with the additional requirements that no length of run shall exceed 100-feet for 1 inch or smaller trade sizes and shall not contain more than two 90-degree bends or the equivalent. Pull or junction boxes shall be installed to comply with these requirements. Provide plastic bushings at all conduit terminations. Provide a grounding bushing on each data and voice conduit.
- B. Completely install all conduit runs and all bushings prior to pulling conductors. All boxes shall be accessible after completion of construction.
- C. Conduits shall be installed from outlet box to above an accessible ceiling. All cables routed through open spaces (no-ceiling below roof deck or above floor deck) shall be routed in conduit. Telecommunications systems, CATV, CCTV, fire alarm and BMCS cables can be installed above accessible ceilings without conduit. Cables installed above accessible ceiling shall be plenum rated. Conduit rough in of these cables shall include a 90-degree turn-out to an accessible location with insulated bushings on the end of the conduit.
 - 1. Provide conduit from each telecommunications outlet box to accessible ceiling plenum.
 - 2. Provide conduit from each security / surveillance device outlet box to accessible ceiling plenum.
 - 3. Provide two conduits for each multi-media outlet box and each outlet box indicated to contain more than four data, audio, or video drops to accessible ceiling plenum.
 - 4. Provide the following minimum conduits for telecommunications and multi-media wall, floor, and ceiling mounted outlet boxes. Use the largest diameter conduit indicated below unless instructed otherwise in writing from the Architect:
 - a. Non-masonry outlet box: Two 1-inch conduits.
 - b. Masonry outlet box: Two 1-inch conduits, or three 3/4-inch conduits.
 - c. Where indicated differently on plans or where conflicts arise, notify the Architect / Engineer prior to installation.

- D. All conduit in which cable is to be installed by others shall have pull string installed. The nylon pull string shall have not less than 200 lb. tensile strength. Not less than 12-inches of slack shall be left at each end. Provide blank cover plate before substantial completion if box is for a future installation after substantial completion of the project. Conduit shall extend to a minimum six inches above nearest accessible ceiling and be turned horizontally with plastic bushing at terminations.
- E. Conduits for Building Entrance Facilities:
 - 1. Underground Outside Plant: Install a pull box every 300-feet or after 180 degree turns.
 - 2. Inside Plant: Install a pull box every 150-feet or after 180 degree turns. All turns shall be large sweeps, not sharp 90s, with the radius of the sweep at least 10X the diameter of the conduit. Hence, a 4-inch conduit requires a 40-inch minimum radial sweep. If field conditions absolutely mandate a sharp 90-degree bend to be installed, then a pull box shall be installed at that location regardless of distance.
 - 3. Building entrance facilities shall not terminate in an IDF or any other space except the MDF.
 - 4. Coordinate the termination location of the building entrance facilities in the MDF with the room layout and equipment configuration.
 - 5. Provide 4-inch conduit unless indicated otherwise. Provide (3) fabric innerducts in each 4-inch conduit.

3.6 EXTERIOR IN-GRADE PULL BOXES

- A. Provide pull boxes where specified and as required.
- B. Pull boxes located in pavement shall be set with proper extensions so that top of cover is flush with pavement.
- C. Pull boxes located in non-paved areas shall be set two-inches above surrounding finished grade. Provide 12-inch wide by 8-inch deep reinforced concrete crown around neck or opening and sloped down away from pull box opening.

3.7 IDENTIFICATION

- A. Conduit Systems: Provide adequate marking of conduit larger than one inch exposed or concealed in interior accessible spaces to distinguish each run as either a power (120/208V or 277/480V) or signal / telecommunication conduit (Fire Alarm, BAS, BMCS, Security, CCTV, Access Control, Intrusion Detection, Telecom, etc.). Except as otherwise indicated, use orange banding with black lettering. Provide self-adhesive or snap-on type plastic markers. Locate markers at ends of conduit runs, near switches and other control devices, near items of equipment served by the conductors, at points where conduit passes through walls or floors or enters non-accessible construction, and at spacing of not more than 50-feet along each run of exposed conduit. Switch-leg conduit and short branches for power connections need not be marked, except where conduit is larger than 1-inch.

END OF SECTION

SECTION 26 0535
ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Electrical connections as required and scheduled, and as specified.

1.2 RELATED WORK

- A. Refer to other Divisions for specific individual equipment electrical requirements.

1.3 QUALITY ASSURANCE

- A. UL Label: Products shall be UL listed to the extent possible.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

- A. General: For each electrical connection indicated, provide a complete assembly including, but not limited to, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other items and accessories needed to complete splices and terminations.
- B. Raceways: Refer to related sections.
- C. Conductors and Connectors: Refer to related section. Conductors at equipment terminations shall be copper.
- D. Terminals: Provide electrical terminals as indicated by the terminal manufacturer for the application.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL CONNECTIONS

- A. General: Install electrical connections as shown, in accordance with applicable portions of the NECA Standard of Installation, and industry practices.
- B. Conductors: Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Where possible, match conductors of the electrical connection for interface between the electrical supply and the installed equipment.
- C. Splice Insulation: Cover splices with electrical insulation equivalent to, or of a higher rating than, insulation on the conductors being spliced.
- D. Appearance: Prepare conductors by cutting and stripping covering, jacket, and insulation to ensure a uniform and neat appearance where cables and wires are terminated.
- E. Routing: Trim cables and wires to be as short as practical. Arrange routing to facilitate inspection, testing, and maintenance.
- F. Motor Connections: Where possible, terminate conduit in conduit boxes at motors. Where motors are not provided with conduit boxes, terminate the conduit in a suitable conduit, and make motor connections. Conduit passing through the housing on connected equipment shall pass through a cleanly cut hole protected with an approved grommet. For all AHU or fan motors and all other motors 10 HP and larger, at the motor connection do not use wire nuts. Provide copper alloy split bolt connectors or compression lugs and bolts. Insulate connection with Scotch Super 88 vinyl electrical tape over rubber tape, or Tyco Gelcap Motor Connection Kit.
- G. Conduit connections to equipment including, but not limited to, Variable Frequency Drives, Manual and Automatic Transfer Switches, Surge Suppression Devices, motor controllers, electrical disconnects, food service / processing equipment, electronics, control panels and Owner furnished equipment:
 - 1. Make conduit penetrations only at the bottom flat surface of the equipment and only where permitted by the equipment manufacturer to avoid un-intentional water entry. Coordinate installation of electrical connections for equipment with

- equipment installation work. Where equipment manufacture does not permit a bottom conduit entry, verify with Owner/Engineer and locate the conduit entry at the side surface as close as possible to the bottom of the enclosure.
2. Where conduit originates from an elevation above the conduit entry, provide a “T” conduit below the enclosure’s bottom elevation. Provide conduit from the conduit up to the enclosure bottom horizontal surface for electrical connection.
- H. Identification: Refer to Electrical General Provisions for identification of electrical power supply conductor terminations with markers approved as to type, color, letter and marker size by the Architect. Fasten markers at each termination point, as close as possible to each connecting point.
- I. Equipment and Furnishings: Refer to other Divisions. Coordinate power and control provisions shown for equipment and furnishings with the provisions required for the furnished equipment and furnishings. Where the power and control requirements are less than or equal to those specified, modifications to power and control provisions shall be made at no cost as a part of coordination. Where power and control requirements are in excess of those shown, notify the Architect in writing of the requirements.
- J. Elevators and Escalators, and Wheelchair Lifts: Refer to Other Divisions. Coordinate power and control provisions shown with the provisions required for the furnished equipment. Where the power and control requirements are less than or equal to those specified, modifications to power and control provisions shall be made at no cost as a part of coordination. Where power and control requirements are in excess of those shown, notify the Architect in writing of the requirements. Provide lockable disconnect switches for main power, control power, lighting power, etc. as required by the NEC and all local codes. Provide all necessary means of two-way communication for emergency phones.

END OF SECTION

**SECTION 26 0537
ELECTRICAL BOXES AND FITTINGS**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide electrical box and fitting work as required, scheduled, indicated, and specified.

1.2 QUALITY ASSURANCE

- A. UL Label: Electrical boxes and fittings shall be UL listed.

PART 2 - PRODUCTS– Provide products manufactured in the USA

2.1 FABRICATED MATERIALS

- A. Interior Outlet Boxes: Provide galvanized steel interior outlet wiring boxes, of the type, shape, and size, including depth of box, to suit respective locations and installation. Construct with stamped knockouts in back and sides. Provide gang boxes where devices are shown grouped. Single box design; sectional boxes are not acceptable, except for wall mounted electronic displays.
1. Type of Various Locations:
 - a. Wall mounted interactive media boards, video displays, televisions, electronic signage and similar installations; recessed wall mounted box for power and/or multi-media (low voltage) outlets: Arlington Industries #TVBS 613, 4-gang steel box with white trim plate.
 - b. Technology, data, voice, video and multi-media outlet boxes at locations other than wall mounted interactive media boards, video displays, televisions, electronic signage and similar installations: minimum 4-inch square (2-gang), 3-inch deep interior outlet boxes. Raco #260H large capacity box with ½ through 2-inch knockouts.
 - c. Security, access control, and video surveillance outlet boxes: single gang, 3-inch deep outlet boxes mounted long axis vertically.
 - d. All other applications: minimum 4-inch square (2-gang) 2-1/8-inch deep boxes.
 - e. Masonry Walls: Galvanized switch boxes made especially for masonry installations; depths of boxes must be coordinated for each installation.
 - f. Surface: Type FS or FD box with surface cover.
 - g. Corrosive locations or natatorium areas: 316 stainless steel construction suitable for the installation.
 - h. Hazardous (Classified) Locations: Explosion proof boxes, seals and fittings.
 - i. Special: Where above types are not suitable, boxes as required, taking into account space available, appearance, and Code requirements
 2. Interior Outlet Box Accessories: Outlet box accessories required as for installation, including covers or wall device plates, mounting brackets, wallboard hangers, extension rings, plaster rings for boxes in plaster construction, fixture studs, cable clamps and metal straps for supporting outlet boxes. Accessories shall be compatible with outlet boxes used and meet requirements of individual wiring.
- B. Damp Location Outlet and Damp or Wet Location Switch Boxes: Deep type, hot dipped galvanized cast-metal weatherproof outlet wiring boxes, of type, shape, and size required. Include depth of box, threaded conduit ends, and stainless steel cover plate with spring-hinged waterproof caps suitable for application. Include faceplate gasket and corrosion-resistant, tamper / vandal proof fasteners.
- C. Wet Location Outlet Boxes: Hot dipped galvanized cast-iron weatherproof outlet wiring boxes, of type, shape, and size required. Include depth of box, threaded conduit ends.

- D. Junction and Pull Boxes: Galvanized sheet steel junction and pull boxes, with screw-on covers, of type, shape, and size, to suit respective location and installation.
 - 1. Type for Various Locations:
 - a. Minimum Size: 4-inch square, 2-1/8-inches deep.
 - b. 150 Cubic Inches in Volume or Larger: Code gauge steel with sides formed and welded, screw covers unless shown or required to have hinged doors. All boxes mounted above ceiling shall have screw covers. Boxes in all other areas with covers larger than 12-inches shall have hinged with screw covers. Knockouts factory stamped or formed in field with a cutting tool to provide a clean symmetrically cut hole.
 - c. Exterior or Wet Areas: 304 stainless steel NEMA 4X construction with gaskets and corrosion-resistant fasteners
- E. Conduit Bodies: Provide galvanized cast-metal conduit bodies, of type, shape, and size, to suit location and installation. Construct with threaded conduit ends, removable cover, and corrosion-resistant screws.
- F. Bushings, Knockout Closures, and Locknuts: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts, and insulated conduit bushings of type and size to suit use and installation.
- G. Outlet boxes in fire rated walls: Provide 2-hour rated gasket within box and below cover, equal to Rectorseal Metacaulk box guard and cover guard.

PART 3 - EXECUTION

3.1 INSTALLATION OF BOXES AND FITTINGS

- A. Install electrical boxes and fittings as shown and as required, in compliance with NEC requirements, in accordance with the manufacturer's written instructions, in accordance with industry practices.
- B. Provide recessed device boxes for wall mounted interactive media boards, video displays, televisions, electronic signage and similar installations.
- C. Provide minimum 4-inch square (2-gang), 3-inch deep interior outlet boxes for technology, data, voice, video, and multi-media outlet boxes at locations other than wall mounted interactive boards, video or visual displays. Provide single gang only, 3-inch deep outlet boxes mounted long axis vertically for security, access control, and video surveillance, coordinate with security equipment installation. Provide minimum 4-inch square (2-gang) 2-1/8-inch deep boxes for all other applications. Where indicated differently on plans or where conflicts arise, notify the Architect / Engineer prior to installation. Box extenders or plaster rings shall not be used to increase size. Provide increased box size as required.
- D. Junction and pull boxes, condulets, gutters, located above grid ceilings shall be mounted within 18-inches of ceiling grid. Junction and pull boxes above grid ceilings shall be mounted in the same room served. Junction boxes and pull boxes required for areas with inaccessible ceilings shall be located above the nearest accessible ceiling area. All junction box or pull box openings shall be side or bottom accessible. Removal of light fixtures, mechanical equipment or other devices shall not be required to access boxes. Outlet boxes above ceiling for low voltage terminations shall face towards the floor.
- E. Use outlet and switch boxes for junctions on concealed conduit systems except in utility areas where exposed junction or pull boxes can be used.
- F. Determine from the drawings and by measurement the location of each outlet. Locate electrical boxes to accommodate millwork, fixtures, marker boards, and other room equipment at no additional cost to the Owner. The outlet locations shall be modified from those shown to accommodate changes in door swing or to clear interferences that arise from construction as well as modifying them to center in rooms. The modifications shall be made with no cost as part of coordination. Check the conditions throughout the job and notify the Architect of discrepancies. Verify modifications before proceeding with installation. Set wall boxes in advance of wall construction, blocked in place and secured.

- Set all wall boxes flush with the finish and install extension rings as required extending boxes to the finished surfaces of special furring or wall finishes. Provide wall box support legs attached to stud to prevent movement of box in wall.
- G. Unless noted or directed otherwise at installation, place outlet boxes as indicated on architectural elevations and as required by local codes.
 - H. Outlets above counters, mount long axis horizontally. Refer to architectural elevations and coordinate to clear backsplash and millwork.
 - I. Provide pull boxes, junction boxes, wiring troughs, and cabinets where necessary for installation of electrical systems. Surface mounted boxes below 9 feet and accessible to the public shall not have stamped knockouts.
 - J. Provide weatherproof boxes for interior and exterior locations exposed to weather or moisture.
 - K. Provide knockout closures to cap unused knockout holes in boxes.
 - L. Locate boxes and conduit bodies to ensure access to electrical wiring. Provide minimum 12-inch clearance in front of box or conduit body access.
 - M. Secure boxes to the substrate where they are mounted, or embed boxes in concrete or masonry.
 - N. Boxes for any conduit system shall not be secured to the ceiling system, HVAC ductwork or piping system.
 - O. Provide junction and pull boxes for feeders and branch circuits where shown and where required by NEC, regardless of whether or not boxes are shown.
 - P. Coordinate locations of boxes in fire rated partitions and slabs to not affect the fire rating of the partition or slab. Notify the Architect in writing where modification or construction is required to maintain the partition or slab fire rating.
 - Q. Exterior boxes installed within 50-feet of cooling towers or water treatment areas shall be of 304 stainless steel, weatherproof NEMA 4X construction.
 - R. Identification: Paint the exterior and cover plates of building interior junction boxes and pull boxes located above accessible ceilings or non-finished areas to correspond to the following colors:
 - 1. Orange: - 480/277 VAC systems
 - 2. Light Blue: - 240 VAC three phase delta systems.
 - 3. Red – All Emergency circuits, regardless of voltage, and fire alarm system.
 - 4. Light Green - 120/208 VAC 3 phase and 120/240 VAC single-phase systems
 - 5. Yellow – Building Management and Control System - BMCS
 - 6. White - Security and Surveillance equipment circuits
 - S. All box covers shall be labeled with Panel ID and circuit numbers of all circuits available in box using permanent black marker. Boxes containing main feeders are to list where fed from and load (example “MSB to Panel HA”). Information listed is to be legible, markovers are not acceptable. Multi-sectional panel numbers are not to be listed on covers (example “LA2” referring to Panel LA sec. 2 is to be listed as “LA”). Label covers for special applications explaining contents (example “Emerg. Gen. Annunciator controls”, “IDF ground”). Do not attach box covers that have both sides painted or labeled differently. In public areas where boxes are painted same color as room per architect, label inside covers. Boxes that are not used shall be labeled as not used and include panel ID. Example “Not Used Panel LA”. Unused raceways not in sight of panel shall be terminated in a box and labeled not used and include panel identification.
 - T. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
 - U. Use flush mounting outlet box in finished areas unless specifically indicated as being used with exposed conduit.
 - V. Locate flush-mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
 - W. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches with stud separation. Provide minimum 24 inches with separation in acoustic rated walls.

- X. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness. Provide UL listed materials to support boxes in walls to prevent movement. Ensure box cannot be pushed inside wall.
- Y. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- Z. Install flush mounting box without damaging vapor barriers, wall insulation or reducing its effectiveness.
- AA. Use adjustable steel channel fasteners for hung ceiling outlet box.
- BB. Do not fasten boxes to ceiling support wires.
- CC. Support systems are to hang vertically straight down. All-thread supports, when used, are not to be installed at an angle or bent.
- DD. Use gang box where more than one device is mounted together. Do not use sectional box.
- EE. Use gang box with plaster ring for single device outlets.
- FF. Support outlets flush with suspended ceilings to the building structure.
- GG. Mount boxes to the building structure with supporting facilities independent of the conduits or raceways.
- HH. Where multiple feeders are in one pull box, conductors shall be wrapped with 3M No. 7700 Arc and fireproof tape.
- II. Provide plaster rings of suitable depth on all outlet boxes. Face of plaster ring shall be within 1/8 inch from finished surface.
- JJ. Equip boxes supporting fixtures designed to accept fixture studs with 3/8-inch stud (galvanized malleable iron) inserted through back of box and secured by locknut. Boxes not equipped with outlets shall have level metal covers with rust-resisting screws.
- KK. Do not mount junction boxes above inaccessible ceilings or in inaccessible spaces. Do not mount junction boxes above ceilings accessible only by removing light fixture, mechanical equipment or other devices. At inaccessible spaces use junction box furnished with light fixture or light fixture wiring compartment UL listed for through wiring.
- LL. No more than 12 conduits containing branch circuits may be installed in any junction or pull box.
- MM. All junction boxes shall be protected from building finish painters' over spray and from fire proofing overspray. Remove protective coverings when painting and fire proofing are complete.
- NN. Bond equipment grounding conductor to all junction and pull boxes.
- OO. Do not mount boxes or conduit bodies on walls directly above electrical panels or switchgear located next to walls.
- PP. Do not mount boxes or conduit bodies within 18 inches of outside edges of roof access openings.
- QQ. Box extenders or plaster rings shall not be used to increase the Code mandated cable capacity of a box. Provide proper size box.

3.2 ADJUSTING

- A. Adjust flush-mounting outlets to make front flush with finished wall material.
- B. Install knockout closures in unused box openings.

END OF SECTION

**SECTION 26 0540
ELECTRICAL GUTTERS AND WIREWAYS**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide electrical gutter work as shown, as specified and as required.
- B. Application: The types of electrical gutters required for the project include the following:
 - 1. Electrical wiring gutters
 - 2. Voice / Data / Video / Communication and signal distribution wireway

1.2 QUALITY ASSURANCE

- A. UL Label: Gutters and wireways shall be UL labeled.

PART 2 - PRODUCTS

2.1 ELECTRICAL GUTTERS AND WIREWAYS

- A. General: Provide hinged electrical gutters and wireways in the types and sizes indicated or required, minimum 16 gauge thickness, with rounded edges and smooth surfaces; constructed in compliance with applicable standards; with features required.
- B. Size: Provide size indicated. Where size is not indicated, construct in accordance with the NEC and other standards. Gutters shall be of manufacturer's standard lengths, without field cutting or field extensions.
- C. Accessories: Provide gutter and wireway accessories where indicated, constructed of same metal and finish as gutters or wireways.
- D. Supports: Provide gutter and wireway supports indicated, conforming to NEC, and as recommended by the manufacturer, and as specified in Section 26 05 33 Conduit Systems.
- E. Materials and Finishes: NEMA 1 gutters and wireways shall have gray powder coat finish over galvanized steel. Gutters and wireways installed outside shall be NEMA 3RX minimum. Gutters or wireways installed within 100-feet of cooling towers, at kitchen or food preparation areas, and natatorium, spa or therapy pool areas shall be of 304 stainless steel NEMA 4X construction.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide gutters and wireways only where specified or required. Use of gutters and wireways shall be kept to a minimum.
- B. Finishing: Remove burrs and sharp edges of gutters and wireways wherever they could be injurious to conductor insulation or jacket.
- C. Installation: Install gutters and wireways where shown or required, in accordance with the manufacturer's written instructions, NEC, NECA "Standard of Installation," and with recognized industry practices to ensure that the gutters and wireways comply with the specified requirements. Comply with requirements of NEMA and the NEC pertaining to installation of electrical gutters.
- D. Grounding: Electrically ground gutters and wireways to ensure continuous electrical conductivity. Provide equipment grounding conductor.
- E. Conductors:
 - 1. Complete gutter and wireway installation before starting the installation of conductors.
 - 2. Provide sufficient space to permit access for installing, splicing, and maintaining the conductors.
- F. A maximum of 12 conduits containing branch circuits shall be allowed to be installed in any gutter or wireway.

END OF SECTION

**SECTION 26 0550
FIRESTOPS**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide firestop as required, and as specified. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.
- B. Types: Firestop required for the project includes smokestop.

1.2 QUALITY ASSURANCE

- A. UL Label: Firestops shall be UL labeled.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Nelson
- B. 3M (Minnesota Mining Manufacturing)
- C. Hilti
- D. Specified Technologies, Inc.
- E. Metacaulk

2.2 MATERIAL AND COMPONENTS

- A. General: Except as otherwise indicated, provide firestop manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by the manufacturer, and as required for installation.

2.3 FIRESTOP

- A. Conduits: Provide a soft, permanently flexible sealant for 1-1/2 to 2 hour rated fireproofing for steel conduits (up to 4" diameter).
- B. Low Voltage Cables, Fiber Optic Cable and Innerduct: Provide Specified Technologies, Inc. EZ-Path single, double, or triple pathways as required.

PART 3 - EXECUTION

3.1 INSTALLATION OF FIRESTOPS

- A. General: Install firestops in accordance with the manufacturer's installation instructions and industry practices to ensure that the firestops comply with requirements. Comply with UL and NFPA standards for the installation of firestops.

END OF SECTION

SECTION 26 0800
ELECTRICAL AND LIFE SAFETY SYSTEMS TECHNICAL COMMISSIONING REQUIREMENTS

PART 1 – GENERAL

1.1. RELATED DOCUMENTS

- 1.1.1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.1.2. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

1.2. SUMMARY

- 1.2.1. The purpose of this Section is to define responsibilities in the Commissioning Process. Other electrical system testing is required under other Division 26 Specification Sections. National Electrical Installation Standards (NEIS) NECA 90-2004, "Recommended Practice for Commissioning Building Electrical Systems", 27th Volume of the NEIS Series, provides additional guidance for the commissioning of electrical systems.
- 1.2.2. Commissioning requires the participation of the Contractor to ensure that all systems are operating in a manner consistent with the Contract Documents. General Commissioning Requirements are provided separately and coordination is detailed in Division 01. Division 26 and 28 Contractors shall be familiar with all parts of Division 01, the General Commissioning Requirements and the Commissioning Plan issued by the Owner's CxA, shall execute all Commissioning responsibilities assigned to them in the Contract Documents and include the cost of Commissioning in the Contract price.
- 1.2.3. Electrical Testing Agency (ETA)
 - 1.2.3.1. The Contractor shall retain an independent Electrical Testing Agency (ETA). Their specific testing responsibilities are delineated in individual technical sections within Division 26. This generally requires checking and testing of the electrical power distribution equipment per National Electrical Testing Association (NETA) Acceptance Testing Standards (ATS).
 - 1.2.3.2. Attend, as needed, Pre-Commissioning Meeting(s), Pre-Installation Meeting(s), and other Project meetings scheduled by the Contractor, Owner or CxA to facilitate the Commissioning process.
 - 1.2.3.3. Obtain all required manufacturer's data to facilitate tests.
 - 1.2.3.4. Provide assistance to the CxA in preparation of the specific System Verification Checklists (SVC) and Functional Performance Test procedures.
 - 1.2.3.5. Generally, the ETA shall provide their standard forms to document the NETA tests to be incorporated into the System Verification Checklists and Functional Performance Test records.
 - 1.2.3.6. The ETA shall assist the Contractor in completing required SVC information such as relay settings, protective overload settings, and equipment ratings utilizing the protocols in the Commissioning Plan.
 - 1.2.3.7. Perform and clearly document all completed Start-up and system operational checkout procedures, providing a copy to the Contractor.
 - 1.2.3.8. Clearly indicate any deficiencies identified during testing and add to an action list for resolution and tracking. The field technicians shall keep a running log of events and issues.
 - 1.2.3.9. Provide skilled technicians to execute testing. Ensure that they are available and present during the agreed-upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem solving.
- 1.2.4. Electrical systems to be commissioned include the following:
 - 1.2.4.1. Unit Substations / Electrical Switchboards
 - 1.2.4.2. Secondary Normal Power Distribution
 - 1.2.4.3. Emergency / Standby Power Distribution
 - 1.2.4.4. Branch Power Distribution and Components

- 1.2.4.5. Emergency Generators and Paralleling Switchgear
- 1.2.4.6. Uninterruptible Power Supplies (UPS)
- 1.2.4.7. Lighting Controls - Occupancy Sensors (25% greater than 25 sensors installed, 100% less than 25 sensors installed)
- 1.2.4.8. Lighting - Daylight Controls (100%)
- 1.2.4.9. Lighting - Time Switch Controls (100%)

1.3. DEFINITIONS

- 1.3.1. Refer to Division 01: General Commissioning Requirements for definitions.

1.4. SUBMITTALS

- 1.4.1. Contractor shall provide Owner and / or CxA with documentation required for Commissioning Work. At minimum, documentation shall include: Detailed Start-up procedures, full sequences of operation, Operating and Maintenance data, performance data, control drawings, and details of Owner-contracted tests.
 - 1.4.1.1. Shop drawings and product submittal data related to systems or equipment to be commissioned.
- 1.4.2. Contractor shall submit to Owner and / or CxA installation and checkout materials actually shipped inside equipment and actual field checkout sheet forms used by factory or field technicians.
- 1.4.3. Where installation testing may be performed in a progressive manner (i.e. grounding systems, insulation resistance, etc.), the Contractor shall prepare and submit to the Owner, A/E team and CxA a testing plan that details how the progressive testing will be performed, documented and presented for approval prior to the start of any testing activities.
- 1.4.4. Contractor shall provide Owner with documentation required for Commissioning work. At minimum, documentation shall include: Detailed Start-up procedures, Full sequences of operation, Operating and Maintenance data, Performance data, Functional Performance Test Procedures, Control Drawings, and details of Owner-Contracted tests.
- 1.4.5. Contractor shall provide any additional documentation needed to complete the requirements of the Commissioning Process
 - 1.4.5.1. Factory Performance Test Reports: Review and compile all factory performance data to assure that the data is complete prior to executing the FPTs.
 - 1.4.5.2. Incorporate manufacturer's initial energizing / startup procedures with System Verification Checklists.
 - 1.4.5.3. Final Electrical Testing Agency (ETA) Reports documenting all NETA requirements indicated in the Project Documents
 - 1.4.5.4. Completed equipment Start-up certification forms along with the manufacturer's field or factory performance and Start-up test documentation.
 - 1.4.5.5. Operating and Maintenance (O&M) information per the requirements of the Technical Specifications and Division 01 requirements.

PART 2 - PRODUCTS

2.1. GENERAL

- 2.1.1. All materials and installation shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
- 2.1.2. Refer to the General Commissioning Requirements for other work products related to the Commissioning Process
- 2.1.3. Contractor is required to follow all applicable industry and site specific safety practices, lockout / tagout requirements, specialized PPE requirements, and provide qualified, trained personnel to execute Commissioning Process requirements.

2.2. TEST EQUIPMENT

- 2.2.1. The Contractor shall provide all specialized tools, test equipment and instruments required to execute Start-up, checkout, and testing of equipment.
- 2.2.2. All specialized tools, test equipment, and instruments required to execute Start-up, checkout, and testing of equipment shall be of sufficient quality and accuracy to test and/or measure system performance within specified tolerances. A testing laboratory must have calibrated test equipment within the previous twelve (12) months. Calibration shall be NIST traceable. Contractor must calibrate test equipment and instruments according to manufacturer's recommended intervals and whenever the test equipment is dropped or damaged. Calibration tags must be affixed to the test equipment or certificates readily available.

PART 3- EXECUTION

3.1. CONSTRUCTION PHASE

- 3.1.1. In each purchase order or subcontract that is written for changes in scope, include the appropriate requirements for submittal data, Commissioning documentation, testing assistance, Operating and Maintenance (O&M) data, and training, as a minimum.
- 3.1.2. Attend Pre-Commissioning Meeting(s), Pre-Installation Meeting(s), and other Project meetings scheduled by the Owner, CxA or Contractor to facilitate the Commissioning process.
- 3.1.3. Provide manufacturer's data sheets and shop drawing submittals of equipment.
- 3.1.4. Provide additional requested documentation to the Owner and / or CxA, prior to O&M manual submittals, for development of System Verification Checklists and Functional Performance Testing procedures.
 - 3.1.4.1. Typically, this will include detailed manufacturer's installation and Start-up, operating, troubleshooting and maintenance procedures, full details of any Owner-contracted tests, full factory testing reports, if any, and full warranty information.
 - 3.1.4.2. In addition, the installation, Start-up, and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Contractor and / or CxA.

This information and data request may be made prior to normal submittals.
- 3.1.5. With input from the Lighting Controls, PCMS vendors and A/E, clarify the operation and control of commissioned equipment in areas where the Specifications, control drawings, or equipment documentation are not sufficient for writing detailed test procedures.
- 3.1.6. During the installation, Start-up and initial checkout process, execute and document related portions of the System Verification Checklists for all commissioned equipment according to the procedures indicated in the Commissioning Plan.
- 3.1.7. Factory Start-ups: Factory Start-ups are specified for certain equipment. Factory Start-ups generally are Start-up related activities that will be reviewed and checked prior to Functional Performance Tests. All costs associated with factory Start-ups shall be included with the contract price unless otherwise noted. Notify the Commissioning Team of the factory Start-up schedule and coordinate these factory Start-ups with witnessing parties. The Commissioning Team members may witness these Start-ups at their discretion.
- 3.1.8. Independent Testing Agencies: For systems that specify testing by an independent testing agency, the cost of the test shall be included in the Contract price unless otherwise noted. Testing performed by independent agencies may cover aspects required in the System Verification Checklists, Start-ups, and Functional Performance Tests. Coordinate with the independent testing agency so that CxA, Owner and/or A/E can witness the test to ensure that applicable aspects of the test meet requirements.
- 3.1.9. Provide skilled technicians to execute starting of equipment and to assist in execution of Functional Performance Tests. Ensure that they are available and present during the

agreed-upon schedules and for a sufficient duration to complete the necessary tests, adjustments, and problem solving.

- 3.1.10. Correct deficiencies (differences between specified and observed performance) as interpreted by the Owner's Project Manager and A/E and retest the system and equipment.
- 3.1.11. During construction, maintain as-built marked-up Drawings and Specifications of all Contract Documents and Contractor-generated coordination Drawings. Update after completion of Commissioning activities (include deferred tests).
- 3.1.12. Provide training of the Owner's operating personnel as specified.
- 3.1.13. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.

3.2. WARRANTY PHASE

- 3.2.1. Execute seasonal or deferred tests, witnessed by the CxA and Owner, according to the Specifications.
 - 3.2.1.1. Complete deferred tests as part of this Contract during the Warranty Period. Schedule this activity with the Owner.
- 3.2.2. Correct deficiencies and make necessary adjustments to O&M manuals, Commissioning documentation, and as-built drawings for applicable issues identified in any deferred or seasonal testing.

3.3. INSTALLATION

- 3.3.1. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- 3.3.2. All installation shall be in accordance with the Project Documents.

3.4. TRAINING

- 3.4.1. Refer to the individual section of this Specification for specific training requirements on each system.
 - 3.4.1.1. Refer to the General Commissioning Requirements and Division 01 of the Project Specifications for overall training requirements related to the Commissioning process and this project.

**SECTION 26 0925
ELECTRICAL CONTACTORS**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Miscellaneous electrical contactors as shown, required, scheduled, and specified.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Provide products produced by one of the following:
Schneider Electric - Square D
ABB-General Electric
Siemens

2.2 CONTACTORS

- A. Provide contactors as shown, required, and specified. The number of poles, ampere-ratings, and pole arrangements shall be as required. Contactors shall conform to the following:
1. Rated for continuous duty at full rated current in an unventilated enclosure. Eight-hour duty ratings are not acceptable.
 2. Contacts shall be readily replaceable, self-aligning, silver alloy.
 3. Load contactors shall be rated for not less than 30A continuous rating. Auxiliary contacts shall be rated for not less than 10 amperes.
 4. Contactors rated for lighting and mixed loads shall have an interrupting capacity of 150% of their continuous duty rating.
 5. Contactors shall be capable of successfully handling inrush currents at 20 times rating.
 6. Provide a minimum of two spare load contacts on each individual contactor rated 60A or less for future use.
- B. Electrically-held Devices shall conform to the following:
1. AC operated units shall have laminated low loss electrical steel core pieces with machine ground pole faces and shading coils.
 2. Units rated at 300A and above shall have DC operating coils and include the necessary rectifier for the AC/DC operation.
 3. Normally open contactors shall be spring-loaded open and magnetically closed.
 4. Contactors for emergency lighting or power shall be normally closed.
- C. Controls: Individual contactors operated by automatic controls shall have 30.5mm HAND-OFF-AUTOMATIC switches, otherwise provide HAND-OFF switches. Contactor controls shall be mounted in the contactor enclosure cover. Contactors serving receptacle loads controlled by local switching shall not have Hand-Off-Auto nor Hand-Off switching.
- D. Control Power. Provide dedicated 120-volt circuit for contactor control power and indicator pilot lights. Do not use same circuit feeding load.
- E. Enclosure:
1. Contactors and control enclosures installed in indoor locations shall be NEMA 1 heavy-duty enclosures unless shown otherwise.
 2. Contactors and control enclosures installed at kitchen and food preparation locations, hose down areas, cooling towers, exterior locations, in greenhouses, and in other corrosive areas shall be NEMA 4X, stainless steel.
- F. Minimum interrupting rating shall be 35KAIC.

PART 3 - EXECUTION

3.1 INSTALLATION OF MISCELLANEOUS ELECTRICAL CONTROLS

- A. Provide electrically held contactors, with line side wiring complete, in accordance with the

National Electrical Code and manufacturer's recommendations.

- B. Fuses: Install fuses where coil control power is fed from line side of contactor.
- C. Adjustment: Adjust operating mechanisms for free mechanical movement.
- D. Coordinate contactor control and operation requirements with the Building Management Control System.
- E. Identify each contactor as specified in Section 26 05 00.
- F. Contactors shall not be installed above ceiling and shall be readily accessible. Locate contactors in same room as panelboard serving the load unless otherwise indicated.

3.2 INTERIOR AND EXTERIOR LIGHTING CONTROL

- A. Parking lot lighting, building mounted exterior lighting, and exterior signage shall be controlled by separate lighting contactors by the specified Building Management and Control System. Interior lighting as noted on the plans shall be controlled as noted on the plans and as specified by the Building Management and Control System. Contractor shall circuit all systems to be controlled by the Building Management and Control System through contactors compatible with system controls and shall ensure the control and operation of lighting control system is complete.
- B. Where control is a three-wire momentary control signal, provide control interface to operate electrically held 2-wire control contactors.
- C. Provide normally closed contactors for emergency lighting and power circuits where contactors are indicated or required.
- D. Provide normally closed contactors for circuits controlled by "emergency power off" or teacher control switches in science classrooms, computer labs, and vocational instructional areas.
- E. Exterior lighting shall be controlled by the Building Management Control System, with local BMCS manual override for both "ON" and "HIGH" settings.

END OF SECTION

SECTION 26 0928
DIGITAL LIGHTING CONTROLS – CY-FAIR ISD

PART 1 - GENERAL

1.1 INTRODUCTION

- A. The work covered in this section is subject to all of the requirements in the General Conditions of the Specifications. Contractor shall coordinate all of the work in this section with all of the trades covered in other sections of the specification to provide a complete and operable system.
- B. Contractor shall provide to the digital lighting control equipment manufacturer all quantities for system including but not limited to room controllers, occupancy sensors, button stations, photocells, emergency lighting controllers, and wire lengths for room controller communications bus.
- C. Contractor shall demonstrate to the Owner, the complete successful operation of system including but not limited emergency lighting operation. Demonstration shall occur a minimum of 30 days prior to the contract schedule completion date. Installing electrical contractor shall replace any failed material during warranty period of one year at no additional cost to the Owner.
- D. Refer to the drawings and other specifications in Division 23 and 26 regarding lighting controls for exterior lighting and other interior areas indicated for control by the Building Management Control System (BMCS) or other means other than the digital lighting controls specified in this section.
- E. Factory startup and commissioning for substantial completion, 90-day verification re-commissioning, and 11-month close-out commissioning shall be provided.

1.2 QUALITY ASSURANCE

- A. Component Pre-testing: All components and assemblies are to be factory pre-tested and burned-in prior to installation.
- B. NEC Compliance: Comply to NEC as applicable to electrical wiring work.
- C. NEMA Compliance: Comply with applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.

1.3 SYSTEM DESCRIPTION & OPERATION

- A. The lighting control system as defined under this section covers the following equipment for local room or local area networks only. Building wide network equipment is not required and shall not be provided unless those capabilities are inherent to the base components required or specified for local room controls only.
 - 1. Digital Room Controllers – Self-configuring, digitally addressable relay controllers with 0-10-volt dimming control for lighting and single relay application-specific plug load controllers when plug load control is specified or required.
 - 2. Digital Occupancy Sensors – Self-configuring, digitally addressable and calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
 - 3. Digital Switches – Self-configuring, digitally addressable pushbutton switches, dimmers, and scene switches with two-way active infrared (IR) communications.
 - 4. Digital Photosensors – If Code required, single-zone closed loop and multi-zone open loop daylighting sensors with two-way active infrared (IR) communications that can provide switching or dimming control for daylight harvesting.
 - 5. Configuration Tools – Handheld remote for room configuration provides two-way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away. Unit to have Organic LED display, simple pushbutton interface, and allow send and receive of

- 6. room variables and store of occupancy sensor settings.
- 6. Emergency Lighting Control Unit (ELCU) – allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building.
- 7. DLM Lighting control system components shall have the capability to be easily expanded in the future to a building wide network functionally using all of the following topologies: a fully wired network.
- B. Lighting controls and automation for exterior lighting and interior areas not controlled by the system specified in this section shall be as required and as specified by other specification sections in Division 23, and 26.
- C. Power and communications for lighting controls provided shall be wired. Use of batteries or wireless communications is prohibited. Dimming control wiring shall not be installed with any line voltage power wiring conduits.

1.4 SUBMITTALS

- A. Submit the specification line-by-line compliance review, shop drawings, and the product data specified below under one cover as a complete submittal.
 - 1. Specification compliance review: refer to Electrical Shop Drawings specification section for instructions and additional information.
 - 2. Shop Drawings:
 - a. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed (standard diagrams will not be accepted).
 - b. Scale drawing for each area showing the exact location of each sensor, room controller, and digital switch.
 - 3. Product Data: Catalog sheets, specifications and installation instructions.
 - a. Include data for each device which:
 - b. Indicates where sensor is proposed to be installed.
 - c. Prove that the sensor is suitable for the proposed application.

1.5 WARRANTY

- A. Wattstopper Digital Lighting Management (DLM) control products: Provide a five-year complete manufacturer's warranty on all products to be free of manufacturers' defects.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. WattStopper (Legrand North America, LLC)
 - 1. System: Digital Lighting Management (DLM). No Substitutions.

2.2 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR SYSTEM

- A. Ceiling mounted (or where specifically indicated or required to be wall mounted to suit installation); passive infrared (PIR), ultrasonic, or dual technology (passive infrared and ultrasonic) digital occupancy sensor. Furnish the system which accommodates the square-foot coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors and accessories which suit the lighting and electrical system parameters.
- B. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
 - 1. Digital calibration and pushbutton programming for the following variables:
 - a. Sensitivity – 0-100% in 10% increments
 - b. Time delay – 1-30 minutes in 1-minute increments
 - c. Test mode – Five second time delay
 - d. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.

- e. Walk-through mode
- f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
- 2. One or two RJ-45 port(s) for connection to DLM local network.
- 3. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
- 4. Device Status LEDs including:
 - a. PIR Detection
 - b. Ultrasonic detection
 - c. Configuration mode
 - d. Load binding
- 5. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
- 6. Manual override of controlled loads.
- C. Units shall not have any dip switches or potentiometers for field settings.
- D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required.
- E. WattStopper product numbers: LMPX, LMDX, LMPC, LMUC, LMDC, LMDW

2.3 DIGITAL WALL SWITCHES

- A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configurations; grey, compatible with building standard stainless-steel wall plates with decorator opening. Wall switches shall include the following features:
 - 1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
 - 2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
 - 3. Red configuration LED on each switch that blinks to indicate data transmission.
 - 4. Blue Load/Scene Status LED on each switch button with the following characteristics:
 - a. Bi-level LED
 - b. Dim locator level indicates power to switch
 - c. Bright status level indicates that load or scene is active
 - 5. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
- B. Two RJ-45 ports for connection to DLM local network.
- C. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required to achieve multi-way switching.
- D. The following switch attributes may be changed or selected using a wireless configuration tool:
 - 1. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
 - 2. Individual button function may be configured to toggle, ON only or OFF only.
 - 3. Individual scenes may be locked to prevent unauthorized change.
 - 4. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
 - 5. Ramp rate may be adjusted for each dimmer switch.
 - 6. Switch buttons may be bound to any load on a room controller and are not load type dependent; each button may be bound to multiple loads.
- E. WattStopper product numbers: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-

105, LMSW-108, LMDM-101.

2.4 ROOM CONTROLLERS

- A. Room Controllers automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room Controllers shall be provided to match the room lighting load and control requirements. The controllers shall be simple to install and shall not have dip switches, potentiometers or require special configuration. The control units shall include the following features:
1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
 2. Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf unit without requiring any configuration or setup.
 3. Device Status LEDs to indicate:
 - a. Data transmission
 - b. Device has power
 - c. Status for each load
 - d. Configuration status
 4. Quick installation features including:
 - a. Standard junction box mounting
 - b. Quick low voltage connections using standard RJ-45 patch cable
 5. Plenum rated
 6. Manual override and LED indication for each load
 7. Dual voltage (120/277 VAC, 60 Hz)
 8. Zero cross circuitry for each load.
- B. ON/OFF/Dimming enhanced Room Controllers shall include:
1. Real time current monitoring
 2. One, two or three relay configurations
 3. Efficient 250 mA switching power supply
 4. Four RJ-45 DLM local network ports.
 5. One 0-10-Volt analog output per relay for control of compatible LED drivers.
 6. The following dimming attributes may be changed or selected using a wireless configuration tool:
 - a. Establish preset level for each load from 0-100%
 - b. Set high and low trim for each load
 7. Discrete model listed for connection to receptacles, for occupancy-based control of plug loads within the space.
 - a. One relay configuration only
 - b. Automatic-ON/OFF configuration
 8. WattStopper product numbers: LMRC-211, LRMC-212, LRMC-213, LMPL-201,

2.5 DIGITAL PHOTOSENSORS

- A. Digital photosensors work with room controllers to provide automatic switching or dimming daylight harvesting capabilities for any load type connected to a room controller. Closed loop photosensors measure the ambient light in the space and control a single lighting zone. Open loop photosensors measure incoming daylight in the space and are capable of controlling up to three lighting zones. Photosensors shall be interchangeable without the need for rewiring.
- B. Digital photosensors include the following features:
1. An internal photodiode that measures only within the visible spectrum and has a response curve that closely matches the photopic curve. The photodiode shall not measure energy in either the ultraviolet or infrared spectrums. The photocell shall have a sensitivity of less than 5% for any wavelengths less than 400

- nanometers or greater than 700 nanometers.
 2. Sensor light level range shall be from 1-10,000 footcandles (fc).
 3. The capability of switching one-third, one-half or all lighting ON and OFF, or raising or lowering lighting levels, for each controlled zone, depending on the selection of room controller(s) and load binding to room controller(s).
 4. For switching daylight harvesting, the photosensor shall provide a deadband or a separation between the “ON Setpoint” and the “OFF Setpoint” that will prevent the lights from cycling after they turn off.
 5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a user-selectable minimum level.
 6. Optional programmable wall switch override to allow occupants to reduce lighting level to increase energy savings or raise and lower lighting levels for a selected period of time or cycle of occupancy.
 7. Infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
 8. Red configuration LED that blinks to indicate data transmission.
 9. Blue status LED indicates test mode, override mode and load binding.
 10. Recessed switch to turn controlled load(s) ON and OFF.
 11. One RJ-45 port for connection to DLM local network.
 12. An adjustable head and a mounting bracket to accommodate multiple mounting methods and building materials. The photosensor may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox.
- C. Closed loop digital photosensors include the following additional features:
1. An internal photodiode that measures light in a 100-degree angle, cutting off the unwanted light from bright sources outside of this cone.
 2. Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software.
 3. Automatically establishes setpoints following self-calibration.
 4. A sliding setpoint control algorithm for dimming daylight harvesting with a “Day Setpoint” and the “Night Setpoint” to prevent the lights from cycling.
 5. WattStopper Product Number: LMLS-400.
- D. Open loop digital photosensors include the following additional features:
1. An internal photodiode that measures light in a 60-degree angle cutting off the unwanted light from the interior of the room.
 2. Automatically establishes setpoints following calibration using a wireless configuration tool or a PC with appropriate software.
 3. A proportional control algorithm for dimming daylight harvesting with a “Setpoint” to be maintained during operation.
 4. WattStopper Product Number: LMLS-500.

2.6 ROOM OR AREA NETWORK

- A. The DLM local network shall be a free topology lighting control physical connection and communication protocol. Digital room devices connect to the network using CAT 5e cables with RJ-45 connectors which provide both data and power to room devices. The DLM local network shall include:
1. Plug n’ Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
 2. Simple replacement of any device in the network with a standard off-the-shelf unit without requiring commissioning, configuration or setup.
 3. Push n’ Learn configuration to change the automatic configuration, including

binding and load parameters without tools, using only the buttons on the digital devices in the local network.

4. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30-feet from a sensor, wall switch or IR receiver.

2.7 CONFIGURATIONS TOOLS

- A. A configuration tool facilitates optional customization of DLM local networks and is used to set up open loop daylighting sensors. A wireless configuration tool features infrared communications, while PC software connects to each local network via a USB interface.
- B. Features and functionality of the wireless configuration tool shall include:
 1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30-feet.
 2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
 3. Read, modify and send parameters for occupancy sensors, daylighting sensors, room controllers and buttons on digital wall switches.
 4. Save up to nine occupancy sensor setting profiles and apply profiles to selected sensors.
 5. Temporarily adjust the light level of any load(s) on the local network and incorporate those levels in scene setting.
 6. Adjust or fine-tune daylighting settings established during auto-commissioning and input light level data to complete commissioning of open loop daylighting controls.
- C. WattStopper Product Numbers: LMCT-100, LMCI-100/LMCS-100

2.8 EMERGENCY LIGHTING

- A. Emergency Lighting Control Unit – A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF/Dimming control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting to be fully bright ON until normal power is restored. Features include:
 1. 120/277 volts, 50/60 Hz., 20-amp driver rating
 2. Push to test button
 3. Auxiliary contact for remote test or fire alarm system interface.
- B. WattStopper Product Numbers: ELCU-200.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION:

- A. Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated. Provide a minimum of eight hours of on-site technical support for the coordination between the BMCS and the Wattstopper lighting controls. Ensure that the sequences of operation involving the BMCS are fully operational as specified and as required.
- B. The installing contractor shall, prior to request of WattStopper factory start up and site commissioning, request an on-site meeting by including local factory representative, Owner and the general contractor, to assist in identification of any open-ended issues, thereby eliminating potential for delays and system commission interruptions.
- C. Upon confirmation of progress by local factory authorities, the installation electrical contractor shall complete the start-up request form found in the WattStopper submittals, including any field changes from the contract documents. This is essential to facilitate substantial completion.

- D. Room controllers shall be installed so that they are easily accessible for replacement or maintenance:
 - 1. Mount lighting control equipment to junction boxes as recommended by the manufacturer.
 - 2. Where accessible ceiling heights are 10-feet AFF or less, room controllers shall be mounted on wall above local control switch location between 4 and 18-inches above the accessible ceiling and 2-inches clear of T-grid for above ceiling access.
 - 3. Where ceiling heights are above 10-feet, room controllers shall be mounted in an ancillary area above the ancillary area local control switch location with accessible ceiling of 10-feet or less. The high ceiling room controller shall be mounted adjacent to the lower ceiling room controller serving the ancillary area. The room controller for the high ceiling and ancillary area(s) may utilize the same room controller for each area if practical. If an ancillary area with low accessible ceiling area is not available, the room controller shall be installed in the same mechanical or electrical room as the electrical panel serving the lighting for that area and clearly labeled for its use and specific room that it controls.
 - 4. Smaller ancillary spaces not separated by doors that adjoin the larger space do not require an additional control zone and shall be controlled with the larger adjoining space zone to reduce complexity.
- E. Lighting controls shall meet the minimum requirements of all local codes in effect when the project will be permitted with whatever exceptions deemed appropriate by the Owner. Wherever possible, minimize the complexity of the controls design to reduce the quantity and types of required sensor hardware, low voltage and line voltage wiring:
 - 1. Provide UL 924 emergency load control devices so that designated emergency interior light fixtures will be controlled ON/OFF/dimmed with adjacent area lighting and be brought to full-bright ON during power failure.
 - 2. Provide full floor area occupancy/vacancy sensor coverage wherever sensors are required.
 - 3. Provide 20-minute time out delay where vacancy sensor control is provided or required.
 - 4. Provide 20-minute or IECC maximum time out delay, whichever is shortest, where occupancy sensor control is provided or required.
- F. Where daylighting controls are required or indicated they shall be fully automatic and full range dimming without local user overriding of the daylighting maximum light level set point or trim level. Local user override to dim to OFF shall be provided. A single photo sensor shall be interfaced with the room controller for each daylighting zone in an area and for each cardinal direction as required by the IECC, and as recommended by the lighting control system vendor.
- G. Low voltage cabling installed above ceiling shall be supported every 5 feet at a minimum height of 3 feet above grid/ceiling but no closer than six inches below deck. Support system shall be ceiling wire attached to structure and clipped to ceiling support grid using Caddy drop wire securing clip #EC311. Cabling shall hang plumb to devices. Low voltage control wiring shall not be installed in the same raceway with line voltage wiring.
- H. Renovation areas: Utilize existing wall box switch locations where line voltage wiring is removed and therefore can be utilized for low voltage control controls and control cabling unless shown or noted otherwise.

3.2 GENERAL SEQUENCES OF OPERATION

- A. Refer to plan and plan details for additional information for specific areas and additional requirements. Where plans or plan details are in conflict with these specifications, provide the more stringent of the two, however verify with the Owner/Architect for clarification for the exact requirements to be provided prior to construction at no additional cost to the

- Owner.
- B. Areas with lighting that requires dimming: Manual ON shall initially bring the lighting level to lighting control system 80-percent set point but not lower than the minimal CFISD design standard-maintained foot-candela light level for the type of space served. Refer to CFISD's Electrical-Light Fixture standards for required maintained light levels. Contractor/vendor shall verify in the field with CFISD during the commissioning process typical acceptable light levels with all ceilings and walls installed and with final paint and finishes applied. It is CFISD's intention to adjust the trim points to a minimally acceptable light level and only adjust as needed due to light fixture lumen depreciation over the lifetime of the light fixtures. This will increase energy savings and extend the lifetime of the lighting system.

3.3 SEQUENCES OF OPERATION FOR SPECIFIC AREAS – REFER TO PLAN DETAILS FOR ADDITIONAL PROJECT SPECIFIC INFORMATION AND INSTRUCTIONS

- A. CORRIDORS, STUDENT AND PUBLIC TOILETS/RESTROOMS ACCESSIBLE DIRECTLY FROM CORRIDORS, AND STAIRS: Includes all hallways and other egress pathways, including attached open access without doors, ancillary spaces such as flex or collaboration spaces, student and public toilets/restrooms with or without a door open to corridor, (This does not include large areas open to the corridor pathway such as the adjoining seating areas of cafeteria, dining, commons, nor shall it include administrative staff toilets or restrooms).
1. Control through BMCS. BMCS occupied (turn ON) or unoccupied (turn OFF) state sent to DLM room controllers. Single DLM occupancy sensor and Hubbell key switch at each security keypad. Sensor to be used for auto ON only; sensor shall not turn corridor lights OFF. Dimming only if required for code required daylight harvesting.
 2. Provide DLM occupancy sensor for body movement detection in corridors (maximum spacing 50-feet) to only turn all corridor lights ON. Provide hand motion sensor coverage in adjoining toilets/restrooms. Provide a DLM Hubbell momentary SPDT key switch next to each security keypad to manually turn corridor lights ON only (to be used if there is a DLM sensor failure or BMCS failure or if BMCS is in un-occupied state). Key switch shall not turn lights OFF. Any corridor occupancy sensor shall trigger all corridor DLM room controllers to turn lights ON at any time of day and will remain ON until a BMCS unoccupied state in which the lights shall turn OFF.
 3. Corridors and their attached open access ancillary general use spaces and attached student/public toilets with or without corridor doors shall be grouped together. Do not switch general use ancillary spaces including student/public toilets with or without doors separately from the corridor that have direct access from an adjoining corridor.
 4. Flex or collaboration spaces open to corridors shall be a separate dimming control zone but shall be grouped with the adjoining corridor's occupancy sensors and BMCS control for BMCS ON/OFF and sensor ON.
 4. Corridor Hubbell SPDT key switch shall be located at each security system control keypad and shall have both load terminals shunted so that either up or down position will turn the lights ON. Label key switches as "CORRIDOR LTG ON".
 5. Do not provide a fire alarm interface since sensors do not turn lights OFF.
 6. DLM locations and quantities shall be kept to a minimum. Multiple corridors shall be grouped and controlled together as much as practical. Individual corridors do not require individual local controls. All corridors are either all on or all off.
 7. Lighted display cases in corridors: Circuit with corridor lighting and with additional

8. local manual line voltage key switch required by IECC identified as “CASE LTG”. Provide separate local switching or dimming for open ancillary flex spaces only if indicated.
 9. No light switches in enclosed stairs. Switch and control all stair floor landings with the first-floor corridor except that one or more light fixture at each floor landing shall be controlled with that respective floor’s corridor lighting. Do not provide sensors in stairs. Un-enclosed stairs shall be considered an extension of the adjoining corridor or space and shall share the adjoining corridor or space-controlled lighting line voltage circuits/zone. Do not provide a separate zone for un-enclosed stairs open to adjoining spaces.
- B. INSTRUCTION AND ADMINISTRATIVE AREAS, OFFICES, LOUNGES/BREAK ROOMS, COPY/PRINT ROOMS, AND SIMILAR AREAS, STORAGE ROOMS THAT ARE 100 SQUARE FEET AND LARGER.
1. SEQUENCE: Provide vacancy sensor control (DLM system manual ON/OFF, auto OFF, DIM).
 2. Instructional areas, classrooms, and large group instruction up to 99-person occupancy provide single zone dimming with DLM control at each entry door. Provide additional zones if the room is equipped with room divider partitions.
 3. Large Group Instruction over 100-person occupancy: Provide up to three dimming zones, one over the presentation display area, one over the seating area, and one for any other specialty lighting or enhanced zone functionality. Provide DLM system master control station only at the main entry door or near the presentation area. Provide entry station(s) at each entry door to provide ON/OFF general lighting.
- C. SHOPS, KITCHEN, FOOD SERVING QUEUE, AND NATATORIUM
1. BMCS to interface with DLM room controllers for occupied/un-occupied state. Un-occupied state shall turn lights off. No occupant sensors for safety and security. Local DLM switches also function as a local override. No dimming
 2. Kitchen/serving: Manual local DLM switches. Locate kitchen/serving switches in supervised locations for on/off control. Occupancy sensor for auto ON only, sensor shall not turn kitchen/serving lights OFF. No dimming (health code lighting requirement supersedes IECC).
 3. Shops: Provide lighting with less than 0.6-Watts per square foot for IECC exception to not require lighting reduction controls or dimming. Occupancy sensor for auto ON only, sensor shall not turn shop lights OFF. No dimming.
 4. Natatorium: Safety and security: BMCS unoccupied state shall turn lights OFF. No automatic sensor lighting controls, no dimming, no light reduction controls. ON/OFF with Hubbell key switches located at main entry/exit door and as directed by CFISD. Provide manual DLM switch for ON/OFF control in swimming coaches’ office or other supervised location as directed by CFISD. The DLM room controller for the natatorium shall be located above an accessible low height ceiling, preferably next to the coaches’ office DLM room controller, or as directed by CFISD.
- D. CAFETERIA, CAFETORIUM, GYMS, LIBRARY, STAGE, LOCKER ROOMS
1. BMCS to interface with DLM room controllers for occupied/un-occupied state. Un-occupied state shall turn lights OFF. No occupant sensors for safety and security. Local DLM switches also function as a local DLM override. Dimming only as required for light reduction, code required daylight harvesting, and as indicated on drawings.
 2. Cafeterias and cafetorium’s: DLM Hubbell SPDT key switches at cafetorium main entry. Dimming switches at main entry and on stage. Cafeterias require only one dimming zone. Cafetorium with stage: Provide up to three dimming zones, zoned from front of house to back of house.

3. School stage general lighting: General lighting for stages and platforms with proscenium curtains or wall dividers shall be controlled as a separate zone. Provide a separate zone for back-of-house stage access ramps. Provide DLM ON/OFF control for the stage general lighting at each entry/exit point to the stage. Provide ramp lighting ON/OFF DLM control at each end of the ramp. Verify zoning and switch locations with theatrical consultant drawings.
 4. Elementary School Cafetorium Theatrical Track Lighting: Locate four ganged wall box 120-volt line voltage dimmer controls on stage at an accessible location, not obstructed by stage curtains, as indicated or as directed by CFISD.
 5. Library: Manual DLM control located in supervised area (behind circulation desk or as directed by CFISD). Hubbell SPDT key switch at main entry door location as directed by CFISD. If dimming zones are provided locate dimming controls in a secured area (circulation desk). Key switch ON function shall force all lights to full bright.
 6. Gyms: Manual DLM Hubbell SPDT key switch. Provide separate zones with Hubbell key switch to enable UIL competition light level for UIL Sports Lighting Standards. Label key switch for UIL competition light level control as court as "UIL COMPETITION ONLY".
 7. Locker rooms: Occupancy sensors control for auto ON/OFF: Set sensors to full-bright on and 20-minute time delay off for safety and security. Manual ON/OFF with DLM Hubbell momentary SPDT key switches located at main entry doors and as directed by CFISD. Provide lighting in these areas with less than 0.6-Watts per square foot for IECC exception to not require lighting reduction controls.
- E. CLOSED-DOOR ADMINISTRATIVE OR PRIVATE TOILETS/RESTROOMS, DRESSING ROOMS, OTHER TOILETS/RESTROOMS WITH DOORS NOT DIRECTLY CONNECTED TO A CORRIDOR:
1. SEQUENCE: Occupancy sensors (DLM system manual ON/OFF, automatic ON/OFF).
 2. Provide dual technology occupancy sensor control for automatic ON/OFF based on occupancy. Set occupancy time delay and sensitivity to device setting maximum for safety and security.
 3. Student/public restrooms with doors not connected to an adjacent egress corridor: Provide CFISD standard Hubbell momentary key switch at student and public toilets/restrooms entry door location for manual DLM ON/OFF.
 4. Private or administrative toilets/restrooms: Provide standard DLM ON/OFF switch for all other restrooms and dressing rooms with doors.
- F. MECHANICAL, ELECTRICAL, PLUMBING, ELEVATOR, AND TECHNOLOGY ROOMS
1. Provide line voltage mechanical time switch withhold at each entry door, wired in parallel as required. Refer to Line Voltage Wiring Device specifications.
- G. CUSTODIAL, JANITORIAL, STORAGE LESS THAN 100SF, UTILITY ROOMS, FREE STANDING REMOTE BUILDINGS (CONCESSION, PRESS BOX, TICKETING, ETC.)
1. DLM vacancy sensor, no dimming except for press box viewing space.
- H. BLACK BOX THEATRES
1. Black box theatres shall be provided with standalone instructional lighting, lighting controls and emergency lighting typical of instructional areas and classrooms.

3.4 IDENTIFICATION FOR LIGHTING CONTROL SYSTEM EQUIPMENT

- A. Above ceiling lighting control system equipment locators: Provide plastic tape machine typed name plate to bottom of ceiling T-grid below relay location. White letters on black background with ¼" high letters on ½" tall label for digital lighting module indicate as: DLM.

- B. Room controller identification: Label each digital room controller with 120/277 Volt circuit (i.e., "HD-27") and room graphic name and number. Do not use architectural room name or number on drawings, use room graphic identification only.
- C. All low voltage wiring shall have "WattStopper" printed on the wire jacket.

3.5 ATTIC STOCK

- A. Provide a minimum of 2 or 5 percent of the project total, whichever is greater, of all other hardware components used.
- B. Provide five configuration handheld remote tools for new facilities or three remote configuration handheld remote tools for renovation facilities.

3.6 FACTORY COMMISSIONING

- A. The installing electrical contractor shall complete, prior to request of WattStopper factory start up and site commissioning, complete installation of all devices, their respective loads landed and confirmed operations, switches installed and confirmed operation of each and every local room network. Upon completion of the installation, the system shall be commissioned by the manufacturer's factory authorized representative who will verify a complete fully functional system.
- B. The installing electrical contractor shall provide a preliminary as-built drawing prior to commissioning. Drawing shall include room by room device ID's and locations of all WattStopper devices.
- C. The factory commissioning shall include the following services. Programming of all button stations, configuration of all occupancy sensors and photocells. Verification of a complete working system.
- D. Provide written or computer-generated documentation on the commissioning of the system including room by room description including:
 - 1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
 - 2. Sequence of operation, (e.g., manual ON, Auto OFF. etc.)
 - 3. Load Parameters (e.g., blink warning, etc.)
- E. The electrical contractor shall provide in writing, both the manufacturer and Owner, with 21-Owner business days written notice of the requested system startup and adjustment date.
- F. The electrical contractor shall provide at least (1) journeyman electrician, familiar with the installation of the system, dedicated to assisting the factory start-up technician for the entire duration of the commissioning process.
- G. Upon completion of the system commissioning the factory-authorized technician shall provide the proper training to the Owner's personnel on the adjustment and maintenance of the system.
- H. Re-commissioning – After 90 days from occupancy re-calibrate all sensor time delays and sensitivities to meet the Owner's Project Requirements. Provide a detailed report to the Architect / Owner of re-commissioning activity.
- I. Close-out commissioning - After 11-months from substantial completion, re-calibrate sensor time delays and sensitivities to Owner's Satisfaction at no additional cost to the Owner. Provide a detailed report to the Architect / Owner of re-commissioning activity.

END OF SECTION

SECTION 26 1217
ULTRA HIGH EFFICIENCY K-RATED TRANSFORMERS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Copper-wound three-phase transformer exceeding US Department of Energy 2016 Efficiency Standards, with extremely low no load losses.
 - 1. Transformers shall be designed to an efficiency standard higher than NEMA Premium.
- B. Load Mix: Transformer shall be UL 1561 Listed to feed a mix of equipment load profiles such as computers without derating or significant degradation of efficiency.

1.2 REFERENCES

- A. FEDERAL REGISTER – US Department of Energy, Office of Energy Efficiency and Renewable Energy. 10 CFR Part 431. Energy Conservation Program for Commercial and Industrial Equipment: Energy Conservation Standards for Distribution Transformers; 2016 Standards
- B. DOE Test Method For Measuring The Energy Consumption Of Distribution Transformers Under Appendix A To Subpart K Of 10 CFR Part 431.
- C. Metering Standards:
 - 1. Computational algorithms per IEEE Std 1459-2000
 - 2. UL 916, UL 61010C-1 CAT III
- D. IEEE-1100 – Recommended Practice for Powering and Grounding Sensitive Electronic Equipment
 - 1. IEEE Standard 1100 documents how typical transformers feeding electronic equipment produce substantially higher losses under electronic equipment load compared to under linear load, requiring derating.
- E. LEED – Leadership in Energy and Environmental Design, U.S. Green Building Council.
- F. ISO 9000:2000 – International Standards Organization - Quality Management System
- G. ISO 14000:2004 – International Standards Organization - Environmental Management System
- H. NFPA 70 - National Electrical Code (Latest Edition)
- I. NEMA ST20-2014 - Dry-Type Transformers for General Applications
- J. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment
- K. US Department of Energy, 10 CFR Part 431, 2015. Energy Conservation Program: Energy Conservation Standards for Distribution Transformers; Final Rule.
- L. IEEE C57.110-2008 – IEEE Recommended Practice for establishing transformer capability when feeding non-sinusoidal load currents.
- M. ISO 17025 – International Standards Organization - General requirements for the competence of testing and calibration laboratories.
- N. UL 1561 - Dry-Type General Purpose and Power Transformers.

1.3 SUBMITTALS

- A. Submit product data including the following:
 - 1. Copy of ISO 14001:2004 Certification of manufacturing operation.
 - 2. Copy of ISO 9001:2000 Certification of manufacturing operation.
 - 3. Construction Details including enclosure dimensions, kVA rating, primary & secondary nominal voltages, voltage taps, BIL, unit weight
 - 4. Basic Performance characteristics including insulation class, temperature rise, core and coil materials, impedances & audible noise level, unit weight

5. Inrush Current (typical 3 cycle recovery)
 6. Short Circuit Current data: Primary (Sym. O/P S/C) & Secondary (L-N/G S/C)
 7. Efficiency Data
 - a. No load and full load losses per NEMA ST20
 - b. Linear load Efficiency data @ 1/6 load
 - c. Linear load efficiency data @ 1/4, 1/2, 3/4 & full load
 - d. Linear Load Efficiency @ 35% loading tested per NEMA TP-2.
 - e. Efficiency under specified K rating load profile at 15%, 25%, 50%, 75%, 100% of nameplate rating.
 8. Copy of Factory ISO 9001 documentation describing nonlinear load test program
 - a. Meter and CT details including model, accuracy, serial numbers and calibration information.
 9. Copy of Linear & Nonlinear load test report for a representative 75kVA transformer
 10. 25 year Product Warranty Certificate
- B. Description of manufacturer's factory nonlinear load test program.
1. In light of the significant degradation of transformer performance when feeding nonlinear load compared to linear load, it is mandatory that the manufacturer test the transformers under nonlinear load representative of real world load mix. Transformers that have not been subject to testing under nonlinear load will not be considered for this project due to the uncertainty related to their real world performance.
 2. Given the lack of a standard for testing transformers under nonlinear load, the manufacturer must have a nonlinear Load Test Program operating in the production environment that is audited and documented per quality standard ISO 9001.
 3. The nonlinear load bank shall consist of a phase-neutral loading with a specified K rating load profile, representative of a mix of typical commercial equipment.
 4. Meters and CTs shall both be revenue class accurate. CTs shall be operated within their approved accuracy loading range. Dual meters shall gather simultaneous primary and secondary energy and harmonic data. Meter and CT details including model, accuracy, serial numbers and calibration information.
 5. Efficiency: Measurements shall be taken at multiple load levels and plotted to show compliance with specification and correlation to the designed efficiency curve.
 6. Efficiency shall be determined purely by measurements using method and instrumentation per NEMA TP-2 Standard. Other methods are not acceptable.
 7. Harmonic data including current and Voltage THD at the different load levels shall be included with the test report.

1.4 SPECIFICATION COMPLIANCE REVIEW

- A. Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect/Engineer/Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a complete copy with the product data.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store and protect products
- B. Store in a warm, dry location with uniform temperature. Cover ventilation openings to keep out dust, water and other foreign material.
- C. Handle transformers using lifting eyes and/or brackets provided for that purpose. Protect against unfavorable external environment such as rain and snow, during handling.

1.6 WARRANTY

- A. Transformer shall carry a 25-year pro-rated warranty, which shall be standard for the product line.

1.7 INTERNATIONAL STANDARDS ORGANIZATION REGISTRATION OF MANUFACTURING PLANT

- A. Registration to current ISO standard is required.
- B. Independent annual audits are conducted.
- C. Product shall be manufactured in registered facility
- D. ISO 9001:2000 Registered – Quality Management System
- E. ISO 14001:2004 Registered – Environmental Management System
 - 1. Transformer manufacturing can produce significant emissions of volatile compounds and significant other waste. To minimize environmental impact, the transformer must be the product of a manufacturing process that has been independently audited to comply with the ISO 14001:2004 Environmental Management System Standard, where strict quality control of raw material sourcing and construction techniques maximize product efficiency and minimize emissions and waste byproducts.
 - 2. ISO 14001:2004 ensures that a facility has had an independent environmental impact assessment of raw material sourcing and all manufacturing processes, and has implemented an independent annually audited program that minimizes environmental impact during manufacturing process and includes a strictly monitored continuous improvement program.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS/PRODUCT

- A. Powersmiths E-Saver OPAL
- B. Power Quality International (Z3 e-Rated)
- C. Mirus - ULLTRA

2.2 TRANSFORMER SPECIFICATION

- A. Minimum UL Listed and Labeled K-Rating: K7
- B. Copper-wound, 3-phase, common core, ventilated, dry-type, isolation transformer built to NEMA ST20 and relevant NEMA, UL and IEEE standards; 200% rated neutral; 60Hz rated; Transformers 750 kVA and less, 600 volt primary and less, shall be UL Listed and bear the label. All terminals, including those for changing taps, must be readily accessible by removing a front cover plate. Windings shall be continuous with terminations brazed or welded. 10kV BIL.
- C. Insulation System:
 - 1. Shall be NOMEX-based with an Epoxy Co-polymer impregnate for lowest environmental impact, long term reliability and long life expectancy
 - a. Class: 220 degrees C
 - b. Impregnate Properties for low emissions during manufacturing, highest reliability and life expectancy
 - c. Epoxy co-polymer

- d. VOC: less than 1.65 lbs./gal (low emissions during manufacturing)
- e. Water absorption (24hrs @25C): less than 0.05% (superior insulation, longer life)
- f. Chemical Resistance: Must have documented excellent performance rating by supplier
- g. Dielectric Strength: minimum of 3200 volts/mil dry (for superior stress, overvoltage tolerance)
- h. Dissipation Factor: max. 0.02 @25C to reduce aging of insulation, extending useful life
- D. Operating Temperature Rise: Maximum 115 degree C in a 40 degree C maximum ambient
- E. Noise levels:
 - 1. 3dB Below NEMA ST-20
 - 2. Production Test every unit. Data to be available upon request.
- F. Exceed minimum efficiency requirements of US Department of Energy, 10 CFR Part 431, April 18, 2013, Energy Conservation Program: Energy Conservation Standards for Distribution Transformers: Final Rule which takes effect January 1, 2016, and comply with the table of maximum no Load Losses, efficiency requirements at 1/6 load, efficiency at 35% load per 10 CFR Part 431, and efficiency at 25% load under the transformer specified K-rating load profile.
- G. Maximum losses and minimum efficiency under linear load conditions per Table 1.

Table 1													
Max and Min Values for Losses and Efficiency for “High Efficiency” Transformers Under K1 Linear and Specified K-Rating Nonlinear Loading													
kVA Rating	No Load	16.5% Load				25% Load				35% Load			
		K1 Linear		Nonlinear		Linear		Nonlinear		K1 Linear		Nonlinear	
	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)	
15	0.054	0.066	97.38	0.067	97.36	0.082	97.86	0.085	97.78	0.109	97.97	0.117	97.82
30	0.091	0.112	97.79	0.113	97.77	0.138	98.19	0.144	98.12	0.183	98.29	0.200	98.13
45	0.124	0.152	98.00	0.154	97.97	0.187	98.36	0.197	98.28	0.248	98.45	0.276	98.28
75	0.181	0.221	98.24	0.225	98.22	0.273	98.56	0.288	98.49	0.362	98.64	0.404	98.48
112.5	0.245	0.300	98.41	0.305	98.38	0.370	98.70	0.393	98.62	0.490	98.77	0.555	98.61
150	0.303	0.370	98.53	0.377	98.50	0.457	98.80	0.486	98.72	0.605	98.86	0.688	98.71
225	0.410	0.501	98.67	0.510	98.64	0.619	98.91	0.659	98.84	0.820	98.97	0.937	98.82
300	0.509	0.622	98.76	0.636	98.73	0.769	98.99	0.829	98.91	1.018	99.04	1.194	98.88
500	0.741	0.906	98.91	0.928	98.89	1.119	99.11	1.213	99.04	1.482	99.16	1.754	99.01

- H. Voltage Taps: For transformers 30kVA-300kVA, provide two 2-1/2% full capacity taps above and below nominal primary voltage. For transformers 15kVA and smaller as well as 500kVA and larger provide one 5% full capacity tap above and below nominal primary voltage.
- I. Impedance: Between 3.0% and 6.0% unless otherwise noted.
- J. Enclosure type: Ventilated NEMA 2; NEMA 3RX aluminum or stainless steel when located outdoors, or as indicated otherwise
- K. Finish Color: Provide light gray ANSI-61 paint finish for transformers located outdoors. Provide manufacturer's standard paint finish color indoors.
- L. Transformer Options:
 - 1. Electrostatic Shield: Each winding is independently single shielded with a full-width copper electrostatic shield
- M. Closed delta 120/240-Volt secondary, 3-phase, 4-wire with center tap neutral winding transformers:
 - 1. KVA rating indicated shall be for balanced 3-phase loading. Center tap winding shall allow for a maximum nominal 70-percent of three-phase kVA rating for unbalanced single phase neutral connected 120/240-Volt loads. The center tap winding shall be individually rated or constructed at twice the capacity of each of the other delta connected windings. (Example: a 225kVA rated center tap transformer would consist of two 75-kVA windings and one 150-kVA center tap winding).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install transformers where shown, in accordance with the manufacturer's written instructions and industry practices to ensure that the transformers meet the specifications. Comply with requirements of NEMA and NEC standards, and applicable portions of NECA Standard of Installation, for installation of transformers. Transformers shall be floor mounted. Ceiling mounted transformers are not acceptable.
- B. Dry-Type Transformer Mounting: Indoor, floor mount transformer on properly sized Amber/Booth Type RVD rubber-in-shear vibration isolators. Transformer enclosures shall make no contact with wall surfaces.
- C. Conduit directly connected to transformer enclosures shall be flexible liquid tight conduit extending for a minimum of 18-inches and a maximum of 24 inches from transformer enclosure as measured along the conduit centerline. Include a ground wire, size in accordance with NEC, internal in each length of flexible conduit.
- D. Grounding: Ground and bond transformers as a separately derived system unless noted otherwise, refer to NEC 250. Installation of bonding strap or bonding conductor between ground and neutral bus shall be witnessed by the Engineer prior to applying power and terminating secondary conductors.
- E. Check for damage and loose connections.
- F. Set the transformer plumb and level.
- G. Provide Seismic restraints where required.
- H. Coordinate all work in this Section with that in other sections.
- I. Verify all dimensions in the field.
- J. Adjust transformer secondary voltages to provide the required voltage at the loads.

3.2 TESTING

- A. Insulation Tests: Before energizing, check transformer windings for continuity.
- B. Winding Current: During initial no-load energizing, check current in each primary winding.
- C. Tap Settings: Measure and record load current and voltage of transformers while loaded

- to verify proper transformer tap settings.
- D. Submittals: Furnish instruments and personnel required for tests. Submit four copies of certified test results to Engineer for review. Reports include transformer tested, date and time of tests, relative humidity, temperature, and weather conditions.
 - E. Performance Validation: To ensure that the products shipped to the job site meet this specification, provide on-site revenue class accurate efficiency and harmonic measurements of transformers once installed and operating at customer's site. Data shall be collected from primary and secondary sides of the transformer simultaneously on a synchronized cycle by cycle basis. The use of two discrete meters that are not synchronized is not acceptable. Sampling shall be of 10% of transformers on the project once installed and operating, as selected by customer. Submit a detailed report to the project engineer.
 - F. Identify non-compliant products to the engineer and replace at no cost to the Owner.
 - G. Notification: Notify Engineer in writing of any deviation from manufacturer's pre-shipment test data.

END OF SECTION

**SECTION 26 2413
SWITCHBOARDS**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Work Included: Switchboard work as shown, scheduled, indicated, required, and specified.

1.2 QUALITY ASSURANCE

- A. UL Labels: Provide switchboards UL labeled for service entrance and meeting requirements of UL 891.
- B. NEMA Compliance: Comply with National Electrical Manufacturers Association (NEMA) Standard PB2, "Dead-Front Distribution Switchboards."

1.3 SUBMITTALS

- A. Indicate:
 - 1. Detailed dimensions for equipment foot print, front and side elevations.
 - 2. Conduit entrance locations and requirements and restrictions.
 - 3. Enclosure material, finish, and NEMA classification type.
 - 4. Nameplate legends.
 - 5. Size and number of bus bars
 - 6. Switchboard instrument details.
 - 7. Electrical characteristics including voltage, ampacity, overcurrent device frame size and trip ratings, withstand ratings, and time current curves of all overcurrent devices and components.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Schneider Electric - Square D
- B. ABB General Electric Co.
- C. Siemens

2.2 MATERIALS AND COMPONENTS

- A. Except as otherwise indicated, provide switchboard manufacturer's materials and components as indicated and as required for a complete installation.

2.3 DEAD-FRONT DISTRIBUTION SWITCHBOARDS

- A. The overcurrent protective device short circuit, coordination and arc flash studies performed by the overcurrent protective device manufacturer shall be used by the respective switchgear vendor(s) to select appropriate equipment, switchgear, and overcurrent protective device characteristics such as but not limited to: equipment bracing, AIC rating, circuit breaker frame size and trip settings, and fuse type/class. The appropriate equipment suitable and required by the studies for code compliance shall be included with the submittal data for review and provided at no additional cost to the Owner. The appropriate equipment recommended by the studies for enhanced selective coordination or enhanced arc flash energy reduction beyond code compliance shall be included with the submittal data for review and consideration purposes by the engineer.
- B. Provide a factory-assembled, dead-front construction, metal enclosed, self supporting, switchboard of voltage, phase, ampacity, and short circuit interrupting rating and bracing shown.
 - 1. Switchboard shall consist of the required number of front and rear aligned vertical sections bolted together to form one metal enclosed rigid switchboard. The switchboard shall be designed as a free-standing with only front access. Rear and/or side access only where indicated to reduce switchboard depth and where

2. NEC required rear access clearance is available.
 2. Switchboard shall include protective devices and equipment shown with interconnections, instrumentation, and control wiring. Small wiring, necessary fuse blocks, and terminal blocks in the switchboard shall be provided. Groups of control wires leaving the switchboard shall be furnished with terminal blocks with numbering strips.
 3. Factory installed permanent lock-off provision for pad-locking in the off position for all protective devices.
- C. Enclosure Construction: The switchboard framework shall be fabricated for floor mounting. The framework shall be formed code gauge steel, welded and bolted together to support cover plates, busing, and component devices.
1. Each section shall have an open bottom and individually removable top plates for installation and termination of conduit. Top and bottom conduit areas shall be shown and dimensioned on the shop drawings. Front plates used for mounting meters, selector switches, or other front-mounted devices shall be hinged, with wiring installed and laced, and with flexibility at the hinged side. Closure plates shall be screw removable and small enough for easy handling by one technician.
 2. Weatherproof enclosure front door(s) shall be pad-lockable and suitable for the intended environmental conditions. When indicated or specified, rear doors shall also be pad-lockable.
- D. Busing: The switchboard busing shall be copper.
1. The bus bars shall be braced to comply with the integrated equipment rating of the switchboard. The main horizontal bus bars between sections shall be located on the back of the switchboard to permit maximum available conduit entry area. The horizontal main bus bar supports, connections, and joints shall be bolted or welded, as required, so as not to require periodic maintenance. Bolted joint connections shall have at least two bolts per joint per phase. Half lapped bus joint construction is not acceptable.
 2. Buses shall be arranged A-B-C, left-to-right, top-to-bottom, and front-to-rear throughout. A ground bus shall be secured to each vertical section structure and extend the entire length of the switchboard.
 3. The main horizontal bus and incoming line shall be isolated and insulated from outgoing busing and cable connections.
 4. Each group mounted section shall have maximum full height bus. Where space is indicated, space shall be bused to install future switches or future circuit breakers sized as shown or a 600 Amp frame size circuit breaker or switch, whichever is greater.
 5. The main horizontal bus shall be non-tapered, fully rated, extended and drilled for future additions and splice plates.
- E. Integrated Equipment Rating: Each switchboard, as a complete unit, shall be given a single integrated equipment rating by the manufacturer. The integrated equipment short circuit rating shall certify that equipment can withstand the stresses of a fault equal to that shown in RMS symmetrical amperes. Ratings shall have been established by actual tests by the manufacturer on similar equipment construction as the subject switchboard. This test data shall be available and furnished, if requested, with or before the submittal of shop drawings.
- F. Indicating Instruments: Switchboard instrumentation shall be digital display, panel mounted, rated for 120V, 60 hertz. The display unit shall be UL listed in accordance with UL 508. The electronic metering device shall have the following features:
1. Voltmeter, phase to phase and phase to ground or neutral.
 2. Current, per phase RMS and 3 phase coverage.
 3. Demand current per phase.
 4. Power factor per phase and 3 phase average.
 5. Real power, 3 phase total.

6. Reactive power, 3 phase total.
7. Apparent power, 3 phase total.
8. Frequency.
9. Average demand real power.
10. Adjustable demand interval (5 to 60 minutes).
11. Nonvolatile memory.
12. Password protected set-up and reset.
13. 3 current transformers with primary to match bus size and 5 ampere secondary with metering class accuracy.
14. Full scale readouts with the following accuracy:
 - a. Current and voltage measurement +/-0.1%
 - b. Power and energy +/-0.2%
 - c. Frequency +/-0.5%
 - d. Power Factor +/-1.0%
 - e. Data update time 0.5 seconds (4 wire)
15. Metering Output.
 - a. Pulse output based on kWh, kvarh, or kVAh.
 - b. Analog output 4-20mA based on kWh, kvarh, or kVAh.
16. Monitoring:
 - a. Harmonic analysis through 63rd with THD and TIF.
 - b. Event recorder.
 - c. Waveform capture.
 - d. Data logger.
 - e. Triggered trace memory.
17. Communication:
 - a. Front port and dual rear mounted RS485 ports.
 - b. BACnet protocol (coordinate with BMCS contractor).
 - c. Mini RTU: digital 4 in/4 out.
 - d. Analog 1 in/4 out.
 - e. Local/remote display of all values.
18. Software:
 - a. Windows based software shall be provided to enable setpoint programming.
- G. The Main Protective Device(s) shall be individually mounted molded case circuit breaker(s):
 1. Adjustable: current, I²t settings, ground fault (where required), instantaneous trip, and short time trip. Solid state true RMS sensing, without fusible elements, 100-percent continuous current rating.
 2. Main protective devices with frame rated at 1000 Amps or greater shall have integral ground fault interrupter and provided with a portable test set or test switch.
 3. Circuit breakers with 1,200 Amp frame and above shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
 4. Provide shunt trip capability and wiring to terminal block for remote shunt trip switch wiring termination weather remote trip device is indicated or not.
- H. Feeder and Branch Protective Devices greater than 1,200 Amps shall be individually mounted:
 1. Molded case circuit breakers:
 - a. Adjustable: current, I²t settings, ground fault (where required), instantaneous trip, and short time trip. Solid state trip true RMS sensing, without fusible elements; 100-percent continuous current rating.
 - b. Energy Reducing Maintenance System switch with local status indicator (ERMS).
 - c. Shunt trip capability and wiring to terminal block for remote shunt trip

- switch wiring termination weather remote trip device is indicated or not.
- 2. Fusible switches:
 - a. Each switch shall have an individual door over the front, equipped with a voidable interlock that prevents the door from being opened when the switch is in the ON position unless the interlock is purposely defeated by activation of the voiding mechanism. All switches shall have externally operated handles.
 - b. Fused switches 600 Amps and below, equipped for class J fuses.
 - c. Fused switches 601 Amps and above shall be equipped with Class R or L rejection type fuse holders. Class RK1 or L of ampere rating and type as indicated on the plans suitable for application of the system.
 - d. When required by the latest edition of the NEC or the AHJ, 1,200 Amp switches regardless of fuse size installed shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
- I. Feeder and Branch Protective Devices 1,200 Amps and below shall be group mounted:
 - 1. Molded case circuit breakers:
 - a. Greater than 250 Amp: Solid state true RMS sensing with adjustable: current, I²t settings, ground fault (where required), instantaneous trip, and short time trip; 80-percent continuous current rating.
 - b. 250 Amp and smaller: Solid state true RMS sensing with fixed current setting by rating plug or dial. Breaker shall have adjustable instantaneous trip function with short time tracking.
 - c. 1,200 Amp frame circuit breakers regardless of trip shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
 - 2. Fusible switches:
 - a. Quick-make, quick-break units utilizing the double-break principle of circuit interrupting to minimize arcing and pitting and shall conform to the ratings shown.
 - b. Individual door over the front, equipped with a voidable interlock that prevents the door from being opened when the switch is in the ON position unless the interlock is purposely defeated by activation of the voiding mechanism. All switches shall have externally operated handles.
 - c. 600 Amps and below equipped for Class J fuses.
 - d. 601 Amps and above shall be equipped for Class R or L rejection type fuse holders.
 - e. When required by the latest edition of the NEC or the AHJ, 1,200 Amp fused switches regardless of fuse size installed shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
- J. Ground Fault Interrupter (GFI) protection: Where shown or required, ground fault protection shall be achieved with adjustable pickup for ground fault currents, field-adjustable from 200 amperes and instantaneous to 60 cycle time delay. The ground fault protection system shall include necessary current sensors, internal wiring, and relays to coordinate opening the monitored faulted circuits.
 - 1. Ground fault protection shall be set at minimum setting for both current and time during construction. The switchboard manufacturer shall include in the submittal data for the switchboard, the minimum setting of the devices and the recommended setting for normal building operation.
 - 2. The ground fault system shall be factory-tested before shipment as specified:
 - a. The switchboard manufacturer shall provide a factory ground fault protection system test for circuit testing and verification of tripping characteristics. The manufacturer shall pass predetermined values of current through the sensors and measure the tripping time for each

- phase and neutral. The measured time-current relationships shall be compared to the trip-characteristic curves. If the ground fault device trips outside the range of values indicated on the curve, the ground fault device shall be replaced or recalibrated.
- b. Relays, electrically operated switches, shunt-trip switches, circuit breakers, and similar items shall have proper voltages applied to their circuits and satisfactory operation demonstrated.
 - c. Upon completion of the factory ground fault protection system test, the current and time on each ground fault device shall be set to minimum values.
- K. Mimic bus: Indicate busing, connections, and devices in single line form on the front panels of the switchboard using red colored plastic strips, fastened flat against the panel face with screws.

PART 3 - EXECUTION

3.1 INSTALLATION OF SWITCHBOARDS

- A. Install switchboards where shown, in accordance with the manufacturer's written instructions, and industry practices to ensure that the switchboards meet the specifications. Provide weatherproof NEMA 3R enclosure housing outdoors, at wet locations, or where indicated on the drawings. Provide NEMA 3RX enclosure housing at corrosive locations of either aluminum or stainless-steel construction suitable for the intended environment when indicated on the drawings.
- B. Comply with the requirements of NEMA and NEC, and NECA Standard of Installation, for installation of switchboards.
- C. Where switchboard is used or indicated as the utility service building disconnect, provide main bonding jumper and neutral to ground bond connected to the building's grounding system. Do not bond neutral to ground when there is a neutral to ground bond upstream from the same derived neutral system serving the switchboard.
- D. Torque bus connections and tighten mechanical fasteners.
- E. Install fuses, of ratings shown, in each switchboard. Provide spare fuse cabinet with three fuses of each size provided. Locate in central plant as directed by Owner.
- F. Concrete Pads: Install switchboards on a 4" reinforced concrete housekeeping pad. The housekeeping pad shall extend 3" beyond the housing of the switchboard unless shown otherwise. Switchboard shall be bolted to the housekeeping pad using 3/8" minimum galvanized bolts and anchors on 30" maximum centers. Furnish the exact position of any block outs, dimensions, and location of the housekeeping pads to prevent delay of the concrete work.
- G. Adjustment: Adjust operating mechanisms for free mechanical movement. Adjust circuit breaker time characteristic curves as recommended by the Fault Current and Coordination Analysis or as directed by the Engineer.
- H. Indicating Instruments: Provide initial factory start-up and programming with Owner present. Integrate with the Building Management System for monitoring and logging of all system data.

3.2 TESTING

- A. Notify Owner's Commissioning Authority (CxA) prior to performing any tests so that the CxA may witness tests at the CxA's discretion.
- B. Pre-energization checks: Before energizing, check switchboards for continuous of circuits and for short circuits.
- C. Switchboard insulation resistance test: Each switchboard bus shall be insulation resistance tested after installation is complete except for line and load side connections. Tests shall be made using Biddle Megger or equivalent test instrument at a voltage of not less than 1000 vDC. Resistance shall be measured from phase-to-phase and from phase-to-ground. Minimum acceptable value for insulation resistance is 2 megohms.

- D. Ground Fault Interrupter (GFI) test: After completion of construction and before final acceptance testing, the ground fault protection system shall be field-tested and reset to the manufacturer's settings for both current and time by a representative of the manufacturer's engineering service department. After the test, set ground fault to 50 percent of overcurrent device rating or 1,200 Amperes, whichever is lower.
- E. Provide thermal infrared scan of switchboard under full load as directed and witnessed by Owner. Correct any deficiencies causing abnormal heating and repeat the scan. Provide digital video documentation with deficiencies corrected for comparison to future test. Make corrections as needed as soon as possible as directed by the Owner. Repeat the scan at the 11-month prior to closeout, and make corrections prior to close-out.
- F. Submittals: Furnish instruments and personnel required for tests. Submit 4 copies of certified test results to the Architect for review. Test reports shall include switchboard tested, date and time of test, relative humidity, temperature, and weather conditions.

3.3 TRAINING

- A. Provide minimum 2 hours of dedicated training provided by a factory authorized representative to Owner's personnel regarding programming, operating, and use of switchboard components including all indicating instruments and safety features.

END OF SECTION

SECTION 26 2414
TESTING, MAINTENANCE, AND MODIFICATIONS TO EXISTING SWITCHBOARDS
AND FEEDER DISTRIBUTION PANELBOARDS

PART 1 -GENERAL

1.1 WORK INCLUDED

- A. Work Included: Switchboard and distribution panel work to existing switchboards or distribution panelboards 800 Amps or more and 600 volts or less as shown, scheduled, indicated, and specified.
- B. Types: Work for the project includes switchboards and feeder distribution panelboards.

1.2 QUALITY ASSURANCE

- A. Original Equipment Manufacturer's (OEM's) Installation and Maintenance Instructions. Coordinate with the OEM's field service representative for specific recommendations for the equipment involved prior to evaluation, testing, and maintenance procedures.
- B. NEMA Compliance: Comply with National Electrical Manufacturers Association (NEMA) Standard PB1 "Panelboards", and Standard PB2, "Dead-Front Distribution Switchboards."
- C. Testing shall be performed by the OEM an InterNational Electrical Testing Association (NETA) National Accredited Company (NAC) and by NETA Certified Technicians with the appropriate NETA level of certification for the testing required.

1.3 SUBMITTALS

- A. Indicate Original Manufacturer's Installation and Maintenance Instructions for testing, exercising, cleaning, and lubrication where available.
- B. Include electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time current curves of all equipment and components.
- C. Original Manufacturer's Inspection Report when available.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Replacement parts shall be manufactured by Original Equipment Manufacturer, (OEM) when available. When OEM parts are not available, third party, UL recognized, manufactured parts may be used. Provide written confirmation on Manufacturer's letterhead indicating OEM parts are not available.

2.2 MATERIALS AND COMPONENTS

- A. Except as otherwise indicated, provide manufacturer's standard materials and components as indicated by published product information, designed, and constructed as recommended, and as required for a complete installation.

2.3 NEW OVERCURRENT DEVICES AND/OR NEW ACCESSORIES

- A. New Indicating Instruments where indicated: Switchboard instrumentation shall be digital display, panel mounted, rated for 120V, 60 hertz. The display unit shall be UL listed in accordance with UL 508. The electronic metering device shall have the following features:
 - 1. Voltmeter, phase to phase and phase to ground or neutral.
 - 2. Current, per phase RMS and 3 phase coverage.
 - 3. Demand current per phase.
 - 4. Power factor per phase and 3 phase average.
 - 5. Real power, 3 phase total.
 - 6. Reactive power, 3 phase total.
 - 7. Apparent power, 3 phase total.
 - 8. Frequency.

9. Average demand real power.
 10. Adjustable demand interval (5 to 60 minutes).
 11. Nonvolatile memory.
 12. Password protected set-up and reset.
 13. 3 current transformers with primary to match bus size and 5 ampere secondary with metering class accuracy.
 14. Full scale readouts with the following accuracy:
 - a. Current and voltage measurement +/-0.1%
 - b. Power and energy +/-0.2%
 - c. Frequency +/-0.5%
 - d. Power Factor +/-1.0%
 - e. Data update time 0.5 seconds(4 wire)
 15. Metering Output.
 - a. Pulse output based on kWh, kvarh, or kVAh.
 - b. Analog output 4-20mA based on kWh, kvarh, or kVAh.
 16. Monitoring:
 - a. Harmonic analysis through 63rd with THD and TIF.
 - b. Event recorder.
 - c. Waveform capture.
 - d. Data logger.
 - e. Triggered trace memory.
 17. Communication:
 - a. Front port and dual rear mounted RS485 ports.
 - b. BACnet protocol (coordinate with BMCS contractor).
 - c. Mini RTU: digital 4 in/4 out.
 - d. Analog 1 in/4 out.
 - e. Local/remote display of all values.
 18. Software:
 - a. Windows based software shall be provided to enable setpoint programming.
- B. New Feeder and Branch Protective Devices greater than 1,200 Amps shall be individually mounted:
1. Molded case circuit breakers:
 - a. Adjustable: current, I²t settings, ground fault (where required), instantaneous trip, and short time trip. Solid state trip true RMS sensing, without fusible elements; 100-percent continuous current rating.
 - b. Energy Reducing Maintenance System switch with local status indicator (ERMS).
 - c. Shunt trip capability and wiring to terminal block for remote shunt trip switch wiring termination weather remote trip device is indicated or not.
 2. Fusible switches:
 - a. Each switch shall have an individual door over the front, equipped with a voidable interlock that prevents the door from being opened when the switch is in the ON position unless the interlock is purposely defeated by activation of the voiding mechanism. All switches shall have externally operated handles.
 - b. Fused switches 600 Amps and below, equipped for class J fuses.
 - c. Fused switches 601 Amps and above shall be equipped with Class R or L rejection type fuse holders. Class RK1 or L of ampere rating and type as indicated on the plans suitable for application of the system.
 - d. When required by the latest edition of the NEC or the AHJ, 1,200 Amp switches regardless of fuse size installed shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
- C. Feeder and Branch Protective Devices 1,200 Amps and below shall be group mounted:
-

1. Molded case circuit breakers:
 - a. Greater than 250 Amp: Solid state true RMS sensing with adjustable: current, I²t settings, ground fault (where required), instantaneous trip, and short time trip; 80-percent continuous current rating.
 - b. 250 Amp and smaller: Solid state true RMS sensing with fixed current setting by rating plug or dial. Breaker shall have adjustable instantaneous trip function with short time tracking.
 - c. 1,200 Amp frame circuit breakers regardless of trip shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
2. Fusible switches:
 - a. Quick-make, quick-break units utilizing the double-break principle of circuit interrupting to minimize arcing and pitting and shall conform to the ratings shown.
 - b. Individual door over the front, equipped with a voidable interlock that prevents the door from being opened when the switch is in the ON position unless the interlock is purposely defeated by activation of the voiding mechanism. All switches shall have externally operated handles.
 - c. 600 Amps and below equipped for Class J fuses.
 - d. 601 Amps and above shall be equipped for Class R or L rejection type fuse holders.
 - e. When required by the latest edition of the NEC or the AHJ, 1,200 Amp fused switches regardless of fuse size installed shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).

PART 3 - EXECUTION

3.1 INSTALLATION, MAINTENANCE, AND MODIFICATION OF SWITCHBOARDS AND FEEDER DISTRIBUTION PANELBOARDS

- A. Comply with the requirements of NEMA, NEC, and NECA Standards for installation, for installation of switchboards and panelboards. Comply with Original Manufacturer's Operation and Maintenance Instructions for testing and periodic maintenance.
- B. Torque all existing and new bus connections and tighten mechanical fasteners to manufacturer's specifications.
- C. Install fuses, of ratings shown, in each new or modified fused switch.
- D. Adjustment: Adjust operating mechanisms for free mechanical movement. Adjust circuit breaker time characteristic curves as directed by the OEM for coordination with downstream overcurrent devices.
- E. Existing Indicating Instruments: Test and calibrate to original manufacturer's specifications. Replace batteries in existing digital instruments where batteries are required. Replace defective indicating instruments with new digital instruments. Provide new digital indicating instruments where indicated on the drawings.
- F. Cleaning: Vacuum the interior of the existing enclosures of all dust and foreign matter. Clean all existing switch contacts according to manufacturer's instructions.
- G. Lubrication: Lubricate all existing exposed switch contacts, pivot points and bearings according to manufacturer's instructions.
- H. Remove any existing circuit breakers or fusible switches that are not functional or not suitable to be reused as "spares".
- I. Provide filler plates where required.
- J. Existing enclosures which indicate rust or corrosion shall be repainted; paint indoor non-stainless steel enclosures with ALKYD enamel coat, and outdoor non-stainless steel enclosures with epoxy enamel coat to match existing color. Do not paint over labels or listings.
- K. Mimic bus: Update the existing mimic bus or provide new mimic bus to indicate busing,

connections, and devices in single line form on the fronts of switchboards. Use red colored plastic strips or match existing material and color format, fastened flat against the panel face with screws.

3.2 TESTING

- A. Provide the services of a NETA NAC or Original Manufacturer's Field Services personnel for initial testing at no additional cost to the Owner. The NETA NAC or Original Manufacturer's Field Services personnel shall provide at minimum, a visual inspection of the existing switchboards or panelboard and shall provide a written report with recommendations regarding the existing condition and recommendations to further testing, maintenance, and in regard to the specified modifications of the existing switchboard or panelboard. The report shall include any deficiencies of the existing switchboard in relation to each component's intended function. In addition, provide deficiencies of the existing switchboard or panelboard with regard to the current National Electrical Code. Provide the written report to the Architect within 14 days of notice to proceed and prior to any demolition or construction. All other testing, maintenance, and modifications shall be provided by the Contractor as specified at no additional cost to the Owner.
- B. Pre-Energization Checks: Before energizing, check for continuous of circuits and for short circuits. Test existing Bolted Pressure Switches according to Original Manufacture's Instructions.
- C. Insulation Resistance Test: Each bus shall be insulation resistance tested after installation and modification is complete except for line and load side connections. Tests shall be made using Biddle Megger or equivalent test instrument at a voltage of not less than 1000 vDC. Resistance shall be measured from phase-to-phase and from phase-to-ground. Minimum acceptable value for insulation resistance is 2 megohms.
- D. Ground Fault Protection System Test: After completion of construction and before final acceptance testing, the ground fault protection system shall be field-tested and reset to the manufacturer's recommFeedended settings for both current and time by a representative of the manufacturer's engineering service department. After the test, set ground fault to 1,200 Amps or 50-percent of the circuit breaker or fused switch frame size, whichever is lowest.
- E. All circuit breakers with adjustable trip settings shall fully tested to verify all fixed and adjustable overcurrent and ground fault trip settings are set to the proper setting and function within manufacture's recommended tolerances.
- F. Provide thermal infrared scan of the under full load prior to testing/maintenance and modifications and of the modified or new equipment sections after construction as directed and witnessed by Owner. Make corrections as needed as soon as possible as directed by the Owner. Repeat the scan at the 11-month prior to close out and make corrections prior to close-out. Provide digital video documentation with test results for comparison between prior condition and post construction modifications and future tests.
- G. Submittals: Furnish instruments and certified personnel required for tests. Submit 4 copies of certified test results to the Architect for review. Test reports shall include project location, testing contractor and testing technician's contact information, equipment tested, date and time of test, relative humidity, temperature, and weather conditions.

END OF SECTION

**SECTION 26 2416
PANELBOARDS AND ENCLOSURES**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Panelboards and enclosures, including cabinet, as shown, scheduled, indicated, and specified.

1.2 QUALITY ASSURANCE

- A. UL Standards: Panelboards and enclosures shall confirm to all applicable UL standards and shall be UL labeled.

1.3 SUBMITTALS

- A. Indicate:
1. Detailed dimensions.
 2. Enclosure material, finish, and NEMA classification type.
 3. Location of main circuit breaker.
 4. Mounting and trim.
 5. Acceptable incoming conductors' size.
 6. Electrical characteristics including voltage, ampacity, overcurrent device frame size and trip ratings, bus material and rating, withstand ratings, lugs, and time current curves of all overcurrent devices and components.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Schneider Electric - Square D
B. ABB-General Electric Co.
C. Siemens

2.2 MATERIALS AND COMPONENTS

- A. General: Panelboards shall be dead-front type equipped with fusible switches or circuit breakers as shown and as required.
- B. The overcurrent protective device short circuit, coordination and arc flash studies performed by the overcurrent protective device manufacturer shall be used by the respective switchgear vendor(s) to select appropriate equipment, switchgear, and overcurrent protective device characteristics such as but not limited to: equipment bracing, AIC rating, circuit breaker frame size and trip settings, and fuse type/class. The appropriate equipment suitable and required by the studies for code compliance shall be included with the submittal data for review and provided at no additional cost to the Owner. The appropriate equipment recommended by the studies for enhanced selective coordination or enhanced arc flash energy reduction beyond code compliance shall be included with the submittal data for review and consideration purposes by the engineer.
- C. Busing Assembly: Panelboard phase, neutral, and equipment ground busing shall be copper. Bus structure and mains shall have ratings as shown and scheduled. Furnish a bare uninsulated ground bus inside each panelboard enclosure. Two section panelboards shall be connected with copper cable, with an ampacity conforming to the upstream overcurrent device. Neutral bus termination quantity for branch circuit panelboards shall match or exceed the maximum number of single pole circuit breakers the panelboard will accept.
- D. Main circuit breakers and feeder / branch circuit breakers:
1. Less than 125 Amps: Thermal magnetic with factory fixed trip.
 2. 125-600 Amps: Thermal magnetic with adjustable instantaneous trip of 5X – 10X with short time tracking.
 3. 601 Amps and larger: Solid state true RMS sensing with adjustable: current set

- by rating plug or adjustable dial, I²t settings, ground fault (where required), instantaneous trip, and short time trip; 80-percent continuous current rating.
- 4. Provide permanent lock-off device for all fire alarm system branch circuit breakers, for all smoke control fans and equipment, and where indicated or required for circuit breaker to be used as a remote safety disconnect switch.
- 5. General requirements:
 - a. Make prepared space provisions for additional breakers or fused switches so that no additional bus or connectors will be required to add circuit breakers or fused switches in the available device mounting space.
 - b. Two and three pole breakers shall have internal common trips.
 - c. All circuit breakers used as the main or branch mounted back-fed main shall be bolt-on. All circuit breakers used in 600 Amp and smaller panelboards shall be bolt-on breakers. Circuit breakers for distribution panelboards rated 601 amps and larger shall have plug-on or bolt-on circuit breakers.
 - d. Branch circuit panelboard shall have interrupting capacity as shown or as required, but in no case less 10k AIC for 120/208/240-Volt systems, and 18k AIC for 277/480-Volt systems.
 - e. 15 and 20 Amp circuit breakers for lighting circuits shall be UL listed switch duty (SWD).
 - f. Personnel ground fault interrupter (GFI) circuit breakers, where shown, shall be maximum 5 mA ground fault trip and shall include a TEST button.
 - g. Equipment ground fault interrupter (EGFI/EGPD) circuit breakers, where shown or required shall be 30mA ground fault trip and shall include TEST button.
 - h. Circuit breakers with 1,200 Amp and larger frame shall have Energy Reducing Maintenance Switching with local status indicator (ERMS).
- E. Fusible Switches for distribution panelboards: Fusible switches shall be quick-make, quick-break type. Each switch shall be enclosed in a separate steel enclosure. The enclosure shall employ a hinged cover for access to the fuses. Interlock cover with the operating handle to prevent opening the cover when the switch is in the ON position. This interlock shall be constructed so that it can be overridden for testing fuses without interrupting service. The switches shall have padlocking provisions in the OFF position. Switches shall include positive pressure rejection type fuse clips for use with UL Class J fuses and be UL labeled for 200,000 AIC.
- F. Spaces: Where space for future breakers or switches is shown, panelboard enclosure shall include removable blank panels or knockouts to allow installation of future breakers or switches, prepared spaces, and panelboard busing shall be complete, including required connectors.
- G. Integrated Equipment Rating: Do not apply series ratings. Each panelboard, as a complete unit, shall have a short-circuit rating equal or greater than the available short circuit current. Rating shall have been established by tests on similar panelboards with the circuit breakers or fusible switches installed.
- H. GFCI circuit breakers not available in the required panel AIC rating shall be series rated with the upstream over current protection device to provide the panelboard with required AIC rating. Coordinate series rating requirements with manufacturer. Mark the panel per NEC 110. The marking shall be visible and state the following: "CAUTION-ENGINEERED SERIES COMBINATION SYSTEM RATED XXX AMPERS. IDENTIFIED REPLACEMENT COMPONENTS REQUIRED".
- I. Panelboard Enclosures:
 - 1. Provide sheet steel enclosures, minimum 16-gauge nominal thickness, with multiple knockouts, unless shown otherwise. Provide all NEMA 1 panelboard

- fronts with spring-loaded door pulls, and flush lock and key, panelboard enclosures keyed alike to match the Owner's standard key system; coordinate with Owner.
2. All NEMA 1 enclosure panelboards shall be hinged "door-in-door" type with interior hinged door with hand operated latch or latches, as required providing access only to circuit breaker or fusible switch operating handles, not to exposed energized parts. Outer hinged door shall be securely mounted to the panelboard box with factory bolts, screws, clips, or other fasteners, requiring a tool for entry. Hand operated latches are not acceptable. Push inner and outer doors shall open left to right. Manufacturer hardware (OEM), screws, and bolts shall be used to secure dead fronts and covers. Do not use third party hardware. Do not use power tools to secure panel hardware. Provide gray powder coat finish over a rust inhibitor.
 3. Equip with interior circuit directory frame, card, and clear plastic covering for panelboards.
 4. Panelboards located in kitchen preparation or natatorium areas shall have Type 316 stainless steel front, door, and trim with a NEMA 1 rating for the entire enclosure.
 5. Panelboards at exterior locations shall be NEMA 4X Type 316 stainless steel.
 6. Panelboards at hose down areas, cooling towers, in greenhouses, and other corrosive locations shall be NEMA 4X 316 stainless steel.
 7. Enclosure shall be for recessed or surface mounting as shown or as required.
 8. Enclosures shall be fabricated by the same manufacturer as panelboards to be enclosed. Multi-section panelboards shall have same physical dimensions.

PART 3 - EXECUTION

3.1 INSTALLATION OF PANELBOARDS AND ENCLOSURES

- A. General: Install panelboards and enclosures, as shown, including electrical connections, in accordance with the manufacturer's written instructions, the requirements of NEC, NECA Standard of Installation, and industry practices. Circuit breakers shall be factory installed except for required field modifications due to actual site conditions.
- B. Coordination: Coordinate installation of panelboards and enclosures with conductor and raceways installation work.
- C. Anchoring: Anchor enclosures to walls and structural surfaces ensuring that they are permanently and mechanically secured.
- D. Directory Card: Provide a typed circuit directory card(s) upon completion of work. Directory card shall be of super heavy-weight index card stock, 110 lb, white. Directory shall include type of load (i.e.: receptacles, lighting, exhaust fan, etc.) and location (i.e.: Room 102, Office, etc.) Room number shall be identified as the actual graphics room number assigned to the space and not the room number identified on the Plans. Circuits with shunt trip shall be identified with the control circuit operating the shunt trip (i.e.: Kitchen Hood No. 2). Shunt trip breakers with common trip circuit shall be grouped in the panelboard (i.e.: circuits 1, 3, 5 and 7).
- E. Fuses: Install fuses, of the ratings and class shown.
- F. Circuit Arrangement: Branch circuits shall be arranged to provide the best possible phase balance, unless shown otherwise.
- G. Panelboards not intended to be used as service entrance (SE) rated or for establishing a separately derived neutral system shall have the factory installed neutral to ground bonding screws and straps removed and disposed of.
- H. Recessed or flush mounted panelboards: Terminate spare conduits in junction box 18-inches above accessible ceiling close to panelboard location. Label junction box cover as "not used" and include panel identification.
 1. Provide (3) 1-inch and (3) ¾-inch spare conduits above accessible ceiling to j-box from each panelboard section.

2. Where recessed panelboard is located above another building floor, also provide (3) 1-inch and (3) ¾-inch conduits to j-box in ceiling space on floor below.
- I. Conductors shall be bent neatly opposite the fuse switch or circuit breaker to which they are to be attached. Vertically installed conductors shall be neatly tie-wrapped. Conductors shall be connected in a neat and professional manner. Conductors brought in from the top or bottom of the cabinet shall be bent neatly opposite the fuse or circuit breaker to which they are to be attached. Each conductor shall be run along the full height of the panel and returned to the circuit breaker or fuse location to allow relocation of the conductor to any position along the bus. Panelboard shall be cleaned of all construction debris prior to substantial completion review. Neutral and grounding conductors shall be installed similar to the phase conductors.
- J. Circuit breakers and conductors installed for SPD devices shall be located on the same side as the SPD to allow the shortest and straightest run of conductors in respect to the location of the SPD device. Route all conductors to the SPD device with straight as possible run, using longest sweep bends and the shortest conductor length possible. Twist all SPD conductors and secure with tie straps wherever possible.
- K. Install copper ground bus for copper ground conductors. Ground conductors size #1 and larger are to be landed to panelboard enclosure with mechanical lugs and not to ground bus.
- L. Install panels so that breaker number 1 is the top left breaker.
- M. In panels that contain multi-layered neutral bus, install neutrals beginning with the back neutral bus row and work forward. Do not make up neutrals on front neutral bus row unless all other rows are full.
- N. Label breaker mounting space with stick-on number labels.
- O. Mount the fully aligned panelboard such that the maximum height of the top circuit breaker above the finished floor shall not exceed 78-inches. Mount panelboards as high as practical and such that the bottom of the cabinets will not be less than 6 inches above the finished floor.

3.2 TESTING

- A. Before energizing, energization, check for continuity of circuits and short circuits.
- B. Provide thermal infrared scan of panelboards under full load as directed and witnessed by Owner. Correct any deficiencies causing abnormal heating and repeat the scan. Provide digital video documentation with deficiencies corrected for comparison to future test. Make corrections as needed as soon as possible as directed by the Owner. Repeat the scan at the 11-month prior to closeout and make corrections prior to close-out.

END OF SECTION

**SECTION 26 2425
ENCLOSED SWITCHES**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Safety and disconnect switch work where required, scheduled, indicated, specified, and required. For switches indicated or rated above 1,200 Amps, provide switchboard construction as specified for switchboards.
- B. UL Approved: Safety and disconnect switches shall have UL approval and the UL label.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Schneider Electric - Square D
- B. ABB-General Electric Co.
- C. Siemens

2.2 ENCLOSED SWITCHES

- A. General: Provide heavy duty type, dead-front, sheet steel enclosed, surface-mounted safety switches of the type and size indicated. Safety switches shall be rated for the voltage of the circuit where they are installed. Safety switches used as motor disconnects shall be rated for the motor horsepower served.
- B. The overcurrent protective device short circuit, coordination and arch flash studies performed by the overcurrent protective device manufacturer shall be used by the respective switchgear vendor(s) to select appropriate equipment, switchgear, and overcurrent protective device characteristics such as but not limited to: equipment bracing, AIC rating, circuit breaker frame size and trip settings, and fuse type/class. The appropriate equipment suitable and required by the studies for code compliance shall be included with the submittal data for review and provided at no additional cost to the Owner. The appropriate equipment recommended by the studies for enhanced selective coordination or enhanced arc flash energy reduction beyond code compliance shall be included with the submittal data for review and consideration purposes by the engineer.
- C. Switch Mechanism:
 - 1. Safety switches shall be quick-make, quick-break type with permanently attached arc suppressor. Constructed so that switch blades are visible in the OFF position with the door open. The operating handle shall be an integral part of the box, not the cover. Switch shall have provision to padlock in the OFF position. Safety switches shall have a cover interlock to prevent unauthorized opening of the switch door when the switch mechanism is in the ON position, or closing of the switch mechanism when the switch door is open.
 - 2. Cover interlock shall have an override mechanism to permit switch inspection by authorized personnel. Current-carrying parts shall be constructed of high conductivity copper with silver-plated switch contacts. Lugs shall be suitable for copper conductors and front removable.
- D. Neutral: Provide safety switches with number of switched poles indicated. Where a neutral is present in the circuit, provide a solid neutral with the safety switch. Where a ground conductor is present in the circuit, provide a separate solid ground with the safety switch.
- E. Auxiliary Contacts: Disconnect switches related to all smoke control fans shall have auxiliary contacts for fire alarm system monitoring of the position of the disconnect switch.

2.3 ENCLOSED SWITCHES WITH OVERCURRENT AND/OR GROUND FAULT PROTECTION

- A. Overcurrent protective devices 1,200 Amps and below:
 - 1. Where switch is intended as a building service disconnect provide solid neutral

- and ground bus and service entrance SE rating.
- 2. Molded case circuit breakers:
 - a. Greater than 800 Amp: Solid state true RMS sensing with adjustable: current, I²t settings, ground fault (where required), instantaneous trip, and short time trip; 80-percent continuous current rating.
 - b. 800 Amp and smaller: Solid state true RMS sensing with fixed current setting by rating plug or dial. Breaker shall have adjustable instantaneous trip function with short time tracking.
 - c. 1,200 Amp and larger frame circuit breakers regardless of trip shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
- 3. Fusible switches:
 - a. Quick-make, quick-break units utilizing the double-break principle of circuit interrupting to minimize arcing and pitting and shall conform to the ratings shown.
 - b. Individual door over the front, equipped with a voidable interlock that prevents the door from being opened when the switch is in the ON position unless the interlock is purposely defeated by activation of the voiding mechanism. All switches shall have externally operated handles.
 - c. 600 Amps and below equipped for Class J fuses.
 - d. 601 Amps and above shall be equipped for Class R or L fuses.
 - e. When required by the latest edition of the NEC or the AHJ, 1,200 Amp fused switches regardless of fuse size installed shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
- B. Ground Fault Interrupter (GFI) protection: Where shown or required, ground fault protection shall be achieved with adjustable pickup for ground fault currents, field-adjustable from 200 amperes and instantaneous to 60 cycle time delay. The ground fault protection system shall include necessary current sensors, internal wiring, and relays to coordinate opening the monitored faulted circuits.
 - 1. Ground fault protection shall be set at minimum setting for both current and time during construction. The manufacturer shall include in the submittal data the minimum setting of the device and the recommended setting for normal building operation.
 - 2. The ground fault system shall be factory-tested before shipment as specified:
 - a. The manufacturer shall provide a factory ground fault protection system test for circuit testing and verification of tripping characteristics. The manufacturer shall pass predetermined values of current through the sensors and measure the tripping time for each phase and neutral. The measured time-current relationships shall be compared to the trip-characteristic curves. If the ground fault device trips outside the range of values indicated on the curve, the ground fault device shall be replaced or recalibrated.
 - b. Relays, electrically operated switches, shunt-trip switches, circuit breakers, and similar items shall have proper voltages applied to their circuits and satisfactory operation demonstrated.
 - c. Upon completion of the factory ground fault protection system test, the current and time on each ground fault device shall be set to minimum values.

2.4 ENCLOSURES

- A. Enclosures in indoor locations shall be NEMA 1 unless shown otherwise.
- B. Enclosures in exterior locations shall be NEMA 4X stainless steel.
- C. Enclosures at kitchen and food preparation locations, exterior kitchen supply and exhaust

fans, hose down areas, cooling towers, in greenhouses, and in other corrosive areas shall be NEMA 4X, stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install safety and disconnect switches where required or indicated, in accordance with the manufacturer's written instructions, requirements of the NEC, NECA Standard of Installation, and industry practices. Provide fuse identification label when fused switches are required showing type and size inside door of each switch. Include devices in coordination study to indicate overcurrent devices will selectively coordinate.
- B. Location: Provide safety switches within 50' and in sight of motor served. There shall be minimum code required clearance in front of safety switch and a clear path in which to access the switch. (i.e.: not having to walk and/or stand on obstacles such as drain pans on floor to service).
- C. Supports: Provide all safety and disconnect switches with galvanized angle or other supports where mounting on wall or other rigid surface is impractical. Switches shall not be supported by conduit alone. Where safety and disconnect switches are mounted on equipment served, the switch shall not inhibit removal of service panels or interfere with access areas, not void the warranty of the equipment served. Provide mounting hardware that will allow removal of safety and disconnect switches with common work tools. Do not utilize drive pin anchors through enclosure.
- D. Ground Fault Interrupter (GFI) test and settings: Where adjustable ground fault interrupter settings are provided or required, after completion of construction and before final acceptance testing, the ground fault protection system shall be field-tested and reset to the manufacturer's settings for both current and time by a representative of the manufacturer's engineering service department. After the test, set ground fault to 50-percent of the overcurrent device rating.
- E. Safety and Disconnect Switches: Install disconnect switches for motor-driven equipment, appliances, motors, and motor controllers within sight of the controller position unless indicated otherwise.
- F. Variable Frequency Drive (VFD) Warning Plaque: Provide VFD warning plaque at safety disconnect switches which are located down-stream of VFDs. Secure plaque to disconnect switch or immediately adjacent to disconnect switch with fasteners. Plaque shall be Yellow-White-Yellow 3-layer plastic laminated engraved with: "WARNING" (1/2 Inch Letters). "TURN OFF VFD BEFORE OPENING THIS SWITCH FOR MAINTENANCE." (1/4 inch letters).
- G. Provide disconnect switch for electric duct heaters.
- H. Where disconnect switch is used or indicated as the utility service building disconnect, provide main bonding jumper and neutral to ground bond connected to the building's grounding system. Do not bond neutral to ground when there is a neutral to ground bond upstream from the same derived neutral system serving the disconnect switch.
- I. Disconnect switches related to all smoke control fans shall have auxiliary contacts for fire alarm system monitoring of the position of the disconnect switch, coordinate with Division 28. Coordinate with fire detection and alarm contractor for the fire alarm and detection system to monitor all disconnect switches open/closed position that serve the smoke control system. All fire alarm and control wiring directly related to the monitoring of the supply power disconnect switches and control of the smoke control fans shall be installed in conduit.

3.2 TESTING

- A. General: Before energizing, check for continuity of circuits and short circuits.
- B. Provide thermal infrared scan of the enclosed switches rated 200 Amps or larger under full load prior to testing / maintenance and modifications and of the modified and new switchboard sections after construction as directed and witnessed by Owner. Make

corrections as needed as soon as possible as directed by the Owner. Repeat the scan at the 11-month prior to closeout, and make corrections prior to closeout. Provide digital video documentation with test results for comparison between prior condition and post construction modifications and future tests.

END OF SECTION

**SECTION 26 2430
FUSES**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Fuse work as shown and scheduled, and as specified.
- B. Types: Fuses required for the project include the following:
 - 1. 250 volt current limiting fuses
 - 2. 600 volt current limiting fuses

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Provide products produced by Bussman or Littlefuse.

2.2 CURRENT LIMITING FUSES - 600 VOLTS AND LESS

- A. General: Provide 200,000 amperes interrupting capacity (AIC) current-limiting fuses of the current ratings shown and voltage rating equal to or greater than the voltage at the point of application.
- B. Types:
 - 1. Fuses in circuits supplying individual motors, groups of motors, or loads including motors, 600 amperes or less, shall be UL Class RK1 or Class J, time delay fuses, Bussman LPS-RK (600V) LPJ-SP (600V), LPN-RK (250V).
 - 2. Fuses in circuits supplying individual motors, groups of motors, or loads including motors, 601 to 4000 amperes, shall be UL Class L time delay fuses, Bussman KRPC "HI-CAP".
 - 3. Fuses in circuits supplying other than motor loads, 600 amperes or less, shall be UL Class RK1, time delay fuses, Bussman LPS-RK (600V), LPN-RK (250V).
 - 4. Fuses supplying surge protection devices (SPD) shall be surge rated for use with SPD devices.

2.3 SPARE FUSES

- A. General: Provide spare fuses in the amount of 10% of each type and size installed, but not less than 3 spares of a specific size and type. Deliver to the Owner at the time of project acceptance. Fuses shall be encased in a labeled steel enclosure with padlock provision, to be wall mounted where directed.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install fuses in fuse holders immediately before energizing of the circuit where the fuses are installed. Fuses shall not be installed and shipped with equipment.
- B. Labels: Place fuse identification labels, showing fuse size and type installed, inside the cover of each switch.

END OF SECTION

**SECTION 26 2773
LINE VOLTAGE WIRING DEVICES**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide wiring device work as shown, scheduled, indicated, and specified. Low voltage and/or digital control switches required for lighting controls and lighting control systems shall be as specified and required for the low voltage and / or digital control lighting system. Refer to drawings or other specification sections for low voltage / digital lighting control systems. Cover plates for lighting control systems shall be as specified in this section unless specifically required otherwise by the low voltage / digital control device bulkhead or form factor.

1.2 QUALITY ASSURANCE

- A. UL Label: Wiring devices shall be UL labeled.
- B. NEMA Standard WD1 and WD6.
- C. Fed. Spec. WC596, W-S-896

1.3 SUBMITTALS

- A. Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect/Engineer/Owner (Does Not Comply, Explanation:.) Do not submit an outline form of compliance, submit a complete copy of the specification section with the product data.
- B. Submit a sample of each style and color of 120-Volt duplex receptacle and each 120/277-Volt switch with related cover plate. Attach plate to wiring device and label back side of plate with job description with permanent black marker.
- C. Submit manufacturer's product data sheet for each style of device and plate on the project.
- D. Submit drawings of plans, elevation and sections of receptacles and outlets in casework, cabinetwork and built-in place furniture. Coordinate dimensions with millwork shop drawings and related architectural drawing series.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Toggle switches, straight blade and twist lock devices, interior cover plates. Devices with manufacturer provided pig tails or plug-in pig tail are prohibited:
 - 1. Leviton
 - 2. Hubbell
 - 3. Pass and Seymour
- B. Dimming
 - 1. Leviton
 - 2. Lutron

2.2 WIRING DEVICE COLOR

- A. Device color shall be gray except 20A, 125V receptacles and toggle wall switches which are directly supplied from an emergency source and located in mechanical, electrical, or technology rooms shall be red, and heavy duty 30 Amp and larger simplex devices which shall be black in color where the building standard color is not available. All wiring devices supplied from an emergency source located in other than mechanical, electrical, or technology rooms shall be gray.
- B. Provide equivalent hospital grade devices where red is not available in grade specified.

Verify with Owner / Architect prior to submitting for approval. Color change kits as required for dimming switches. Low voltage lighting control devices specified elsewhere shall match the line voltage wiring device color specified in this section.

2.3 RECEPTACLES

- A. Industrial grade tamper resistant smooth face duplex receptacles, 2 pole, 3 wire grounding, with ground connection and poles internally connected to mounting yoke, with metal mounting straps, back and side wired with screw type terminals, NEMA indicated, (X=color designation).
1. 20A, 125V duplex NEMA #5-20R: Leviton #5362-SGX
 2. 20A, 125V isolated ground duplex NEMA #5-20R: Leviton #5362-IGX
 3. 20A, 125V ground fault circuit interruption (GFCI) NEMA #5-20R weather and tamper resistant: Leviton #G5362-WTX
 4. 20A, 125V weather resistant (WR), tamper resistant: Leviton #TWR20-GY
 5. 20A, 125V plug load control, split circuit marked for "controlled", tamper resistant: Leviton #TDR20-S1G
 6. 15A, with 20A feed-through, NEMA #5-15R, 125V duplex, arc fault (AFCI), tamper resistant: Leviton #AFTR1-HGX
- B. Heavy-Duty Simplex: Single heavy-duty type receptacles, with green hexagonal equipment ground screw, with metal mounting straps, back or side wiring, black molded phenolic compound.
1. 15-60A, 125-250V, straight blade, NEMA configuration as indicated or as required by Owner.
 2. 15-50A, 125-480V, twist lock, NEMA configuration as indicated or as required by Owner.
- C. Hospital grade receptacles, 2 pole, 3 wire grounding, with ground connection and poles internally connected to mounting yoke, with metal mount straps, back and side wired with screw type terminals, molded phenolic compound, NEMA configuration indicated. Hospital grand devices are required for all audio/visual system equipment outlets, refer to Specification Section 27 41 00 Performance and Broadcast Audio/Video Systems for more information.
1. 20A, 125V grounded duplex NEMA #5-20R: Leviton #8300-X
 2. 20A, 125V isolated ground duplex NEMA #5-20R: Leviton #8300-LIG (Orange color devices)
 3. 20A, 125V ground fault circuit interruption (GFCI) with indicator light: Leviton NEMA 5-20R-8898-HGX
 4. 20A/125V Tamper Resistant Duplex NEMA 5-20R: Leviton 8300-SGX

2.4 WALL SWITCHES

- A. Toggle: Industrial grade flush toggle switches, with mounting yoke insulated from mechanism, equipped with plaster ears, switch handle, back and side-wired screw terminals.
1. Single-pole, 120/277V, 20A switch: Leviton #1221-2X
 2. Double pole 120/277V, 20A switch: Leviton #1222-2X
 3. Three-way, 120/277V, 20A switch: Leviton #1223-2X
 4. Four-way, 120/277V, 20A switch: Leviton #1224-2G
 5. Pilot light single-pole, 120/277V, 20A switch: Leviton #1221-PL
 6. Momentary, 120/277V, 20A, single-pole double throw, center off: Hubbell only, #HBL 1557G
- B. Toggle key operated switch (verify manufacture and key type with Owner prior to construction).
1. Single-pole, 120/277V, 20A key operated switch: Hubbell HBL #1221GY
 2. Two-pole, 120/277, 20A key operated, Hubbell HBL #1222GY
 3. Three-way, 120/277V, 20A key operated switch: Hubbell HBL #1223GY

4. Four-way, 120/277V, 20A key operated switch: Hubbell HBL #1224GY
5. Momentary, single pole double throw, center off, 20A key switch: Hubbell #HBL 1557LG
6. Key: Hubbell #HBL 1209. Key switches shall be keyed alike to match the Owner's standard key system. Coordinate with Owner.

2.5 WALL DIMMERS

- A. Wall Box Dimmers: Self-contained, wall box mounted, linear slide square law dimmers with ON/OFF switch. Dimmers shall operate continuously at rated load in an ambient temperature up to 40°C and an input of 100 to 277V. Heat sink fins may be removed only as approved by Owner / Engineer for narrow ganging after applying de-rating.
 1. Single-pole, 120/277V, 1000/2308 Watt incandescent / magnetic low voltage: Leviton #AWSMT-MBW.
 2. Single-pole, 120/277V, 1500/3463 Watt incandescent / magnetic low voltage, 2-gang heat sink: Leviton #AWSMT-MCW.
 3. Single-pole, 120/277V, 1920/4432-Watt LED / fluorescent 0-10V dc, 75 mA current sink: Leviton #AWSMT-7DW.
 4. Three, four- or five-way remote switch: Leviton #AWSRT-00W.
 5. Color change kit as required.

2.6 GFCI – GROUND FAULT CIRCUIT INTERRUPTER, BLANK FACE

- A. 20A, 125V, GFCI, switch rated, blank face feed through, Hubbell #GFBF20GYL, gray finish, stainless steel cover plate black laser engraved with device protected, (example: VENDING MACHINE GFCI).

2.7 INTERIOR WALL COVER PLATES AND FASTENERS

- A. Type 302 non-magnetic stainless-steel with satin finish (also required for wall box device cover plates for low voltage and digital lighting controls specified elsewhere).
- B. Cover plate laser plate engraving for device identification (other than low voltage lighting controls).
 1. Provide laser cover plate engraving with black filling for all wiring devices indicating panelboard name, circuit, and voltage.
 2. Wiring devices connected to emergency/stand-by generator or inverter shall include the word "EMERGENCY" in black.
 3. Text orientation shall be upright, readable from left to right when cover plate is installed.
 4. Remotely located lighting switches shall also indicate the room or area and zone controlled by each switch. Coordinate specific wording with Owner/Architect.
 5. Blank face GFCI cover plates shall also intuitively indicate the load or equipment served, device, or area protected downstream ("RM RECEPTS", "HOOD RECEPTS", "VENDING", "REFRIG", etc.) For other loads, Owner/Architect shall determine name plate wording.

2.8 EXTERIOR COVER PLATES

- A. Thomas & Betts CK Series, cast aluminum standard depth, locking mount, while-in-use, wet location, universal configuration.
 1. Vertical mount receptacle: #CKSUV
 2. Horizontal mount receptacle: #CKMU
 3. Two-gang: #2CKU
 4. 30-60 Amp Devices: #CKLSUV

2.9 CORD REELS AND DROP CORDS

- A. Cord Reels:
 1. Lighted cord reels: Industrial grade, LED hand Lamp only, 125V, 45-foot 16/3

2. SJEO cord, white finish, LED hand lamp. Hubbell #HBLI45163LED with #HBL340PB pivot base.
 2. 20 Amp (2) duplex receptacle cord reels: Industrial grade, 125V, (2) 20A duplex receptacles, GFCI protection, 45-foot 12/3 SJO cord, white finish, yellow outlet box. Hubbell #HBLI45123GF220 with #HBLI340PB pivot base.
 3. 30 Amp receptacle cord reels: Industrial grade, 125/250V, 30A, 45-foot 10/4 SJO cord, white finish, yellow outlet box. Hubbell #HBLI45104 with #HBLI340PB pivot base. 30 Amp NEMA receptacle termination as required by Owner.
 4. 50 Amp receptacle cord reels: Industrial grade, NEMA 4 wet location, 600V, 55A, 50-foot 6/4 SOOW cord, yellow finish, self-retracting, with NEMA 50-Amp maximum receptacle termination as required by Owner. KH-Industries RTMH4L-WW-K6K.
 5. Recessed enclosure for 20 and 30-Amp cord reels recessed above T-grid drop ceilings: Hubbell #HBLIPRBOX recessed cord reel enclosure, white finish, plenum rated.
- B. Drop cord receptacles:
1. 20A, 125V, 25-feet 600 VAC, 3-conductor 12 AWG SOOW cable, twist lock plug, two 125V, 20A duplex WR GFCI outlets, safety yellow rubber outlet box, mesh strain relief cord grips. KH Industries #PP4DD-520-B12F-520.
 2. 20A, 125/250V, 25-feet 600 VAC, 4-conductor 12AWG SOOW cable, twist lock plug, four 125/250V NEMA L1420P outlets, safety yellow rubber outlet box, mesh strain relief cord grips. KH Industries #PP7DD-520-B12F-L1420.
 3. 30-60 Amp, voltage, NEMA plug/receptacle as required by Owner, SOOW cable, number of conductors and length as required, mesh strain relief cord grips.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Cover plates for receptacles and toggle switches shall be of the same manufacturer throughout unless otherwise noted.
 1. Key switches and keys shall be as specified and also as approved by Owner.
 2. Submit samples for each specified toggle switch and duplex receptacle color to Architect.
- B. Install wiring devices where shown and as required, in accordance with manufacturer's written instructions, requirements of NEC, and in accordance with industry practices. Do not install devices until wall construction and wiring is completed.
- C. Install receptacles and switches only in electrical boxes that are clean, free from building materials, debris, and similar matter.
- D. Install wiring devices plumb and aligned in the plane of the wall, floor, ceiling or equipment rack.
- E. Install switches in boxes on the strike side of doors as hung. Install so the up position will close the circuit or will be the highest level of illumination. Where more than one switch is in the same location, install switches in a multi-gang box with a single cover plate.
- F. Provide a cover plate for every wiring device and blank cover plates for unused rough-in-only boxes that matches the building standard. Fasten all plates outdoors with type 302 Allen Head "tamper-proof" screws.
- G. Mounting heights of all wiring devices shall comply with local accessibility standards and local codes, except where wiring devices are indicated for special purpose and access is only required by maintenance or service personnel.
- H. Refer to Architectural drawing and elevations, etc. for exact location of wiring devices. Coordinate location of all wiring devices with other trades, specialty items, and millwork and resolve all conflicts prior to rough-in. Field coordinate exact mounting location with all trades to avoid and resolve conflicts during construction.
- I. Locate receptacles for electric drinking fountains/coolers and bottle fill stations below equipment so that the receptacle is accessible and concealed as much as practical from

- public view by the equipment open cowling so that the receptacle remain readily accessible. For dual level basin equipment, locate receptacle under the upper basin.
- J. Provide convenience outlet receptacle within 25-feet of all new electrically operated mechanical equipment.
 - K. Where exterior receptacles are intended for continuous use, mount in horizontal position with while in use cover plate. (Exterior electric drinking fountains, ice makers, ice storage bins, landscape lighting low voltage transformers, seasonal decorative lighting, etc.)
 - L. Install wall box dimmers to achieve full rating specified after de-rating for ganging as recommended by manufacturer.
 - M. Do not share neutral conductor on load side of dimming switches.
 - N. Install receptacles with grounding pole down, or as directed by Owner only for equipment with a corded plug that requires a different orientation (i.e., flat plug assembly), to ensure cord remains plugged and cord hangs down tight against wall. If installed horizontally, install with neutral pole on top.
 - O. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.
 - P. Provide field installed pigtail to each receptacle and each switch. Neutral and phase conductors shall be installed using side or rear entry lugs only. Do not wrap conductors around screw terminals. Tighten all screws and lugs as recommended by the manufacturer.
 - Q. All receptacles and switches shall have a minimum of two wraps of Scotch 33 or equivalent tape around terminal screws.
 - R. Provide toggle switch within sight of all trap primers, circulation pumps, 120-Volt motors and motorized equipment to serve as the equipment disconnect switch.
 - S. Mount cord reels and cord reel recessed enclosures to structure with galvanized steel struts and as recommended by manufacturer. Field verify exact location of cord reels with Owner/Architect. Mounting location shall avoid conflicts with piping, light fixtures and ductwork, etc. when cord reel is extended and retracted. Set ball stop as directed by Owner / Architect. Provide hand lamp only type cord reels in commercial / educational automotive garages with classified (hazardous) locations. Provide local toggle switch at standard switch height for hand lamp only cord reels.
 - T. Mount drop cord suspension hook or j-box to structure to support the cord's weight and additional normal use pulling tension and as recommended by manufacturer. Use cable grips, either with cord grip hanging hook at open ceilings or with chrome plated escutcheon cover plate mounted to recessed j-box at finished ceilings. Field verify exact location, drop height, and NEMA outlet configuration of drop cords with Owner/Architect. Provide weatherproof receptacle cap or covers if located in wet location. Mounting location shall avoid conflicts with piping, light fixtures and ductwork, etc.

3.2 GROUND FAULT PROTECTION FOR PERSONELL

- A. When GFCI personnel protection receptacles are not commercially available or cannot be installed at a readily accessible location or indicated otherwise on the drawings, GFCI personnel protection shall be provided by a remote blank face GFCI wiring device or by an up-stream GFCI receptacle that also provides downstream GFCI protection and located in a readily accessible location. When branch circuit breaker device with integral GFCI protection is required or specified, it shall be within the manufacture's recommended distance limitations of the connected receptacle(s) or load(s) for proper GFCI personnel protection at the farthest outlet.
- B. GFCI personal protection locations include but are not limited to the following:
 - 1. For other than dwelling units: All single phase 125-250-Volt (150-Volts to ground or less) receptacles 50-Amperes or less, and all three phase 125-250-Volt (150-Volts to ground or less) receptacles 100-Ampres or less in the locations indicated below.
 - 2. Dwelling units: All single phase 125-250-Volt receptacles installed in the following

- locations indicated below.
3. Provide personnel GFCI protection as indicated above in the following locations and all additional locations as required by the NEC.
- a. Outdoors (with exceptions for not readily accessible receptacles with dedicated branch circuits for snow melting, deicing, pipeline/vessel heat receptacles. Provide these loads with 30mA EGFI circuit breaker protection).
 - b. Bathrooms/toilets/restrooms
 - c. Janitors/custodial closets and mop sinks.
 - d. Laundry areas
 - e. Parking structures, service garages, garages and accessory buildings
 - f. Basements, crawl spaces (including 120-Volt lighting)
 - g. Within 6-feet of all water sources including sinks, mop-sinks, lavatories, bathtubs, shower stalls, faucets, eye wash stations, emergency shower stations
 - h. Indoor damp and wet locations
 - i. Locker rooms
 - j. Indoor swimming pools and natatoriums areas and adjacent corridor/hall convenience receptacle outlets located within 25-feet of all access doors.
 - k. Non-dwelling unit therapeutic tubs/pools/whirlpool areas and adjacent corridor/hall convenience receptacle outlets located within 25-feet of all access doors.
 - l. Receptacles serving dwelling unit kitchen counter tops
 - m. Vending machines
 - n. Elevators, dumb waiters, escalators, moving sidewalks: receptacles in pits, hoist ways, well ways or those mounted on the cars of elevators and dumb waiters.
 - o. Electric vehicle charging equipment.
 - p. All receptacles serving kitchen or food preparation counter tops.
 - q. Automotive vacuum machines
 - r. Drinking water fountains/coolers and bottle fill stations
 - s. Corded high-pressure spray washing machines
 - t. Tire inflation machines
 - u. Dish washers
 - v. Receptacles at end of cord reels or drop cords.
 - w. Boat houses, boat hoist, and all pier/dock receptacles and lighting (excludes shore power that requires GFPE).
 - x. Central plant, mechanical rooms and electrical rooms
 - y. Wood, metal, or other material fabrication or vocational training shops.
 - z. Receptacles that serve educational science and science prep room counter tops.
- C. Where a GFCI protected receptacle outlet is required or indicated behind vending machine, refrigerators or other equipment, provide remote GFCI blank face in same room as protected receptacle and at a readily accessible location with standard receptacle outlet behind equipment. Refrigerators shall be GFCI protected only where located within 6-feet of power cord distance from the edge of a sink to the surface of the refrigerator.
- D. Unless indicated otherwise, locate blank face GFCI device near light switches at same height as light switches or ganged with the light switch. Provide GFCI protection for all receptacle outlets located below 42-inches in all infant through 2-year old day care and similar areas designated for occupancy by infant through 2-year old day care occupants so the GFCI device can easily be intentionally tripped or tested and reset.
- E. Provide branch circuit breaker 30mA (EDP) or 100mA (EPE) equipment protection for utilization equipment as required by the NEC and where indicated on the drawings.

3.3 PERFORMANCE AND BROADCAST AUDIO VISUAL SYSTEMS RECEPTACLES

- A. All 125-Volt receptacles providing power to A/V systems from dedicated A/V power transformers shall be hospital grade, isolated ground type receptacles. The isolated ground conductor connection shall be in addition to the solid green raceway/box grounding conductor.

3.4 TESTING

- A. Before energizing, check for continuity of circuits, short circuits, and grounding connections.
- B. After energizing, check wiring devices to demonstrate proper operation and receptacles for correct polarization, voltage and phase orientation if intended 3-phase equipment is phase orientation dependent for proper motor rotation or operation.
- C. Test each individual GFCI receptacle and all downstream receptacles protected by an upstream GFCI device with simulated ground fault tester, make corrections as necessary.
- D. Operate each wall switch with circuit energized and verify proper operation.

3.5 ATTIC STOCK

- A. For each type of wiring device cover plate requiring the word “EMERGENCY”, provide attic stock of 20 cover plates of each type (simplex, duplex, triplex, etc.).

END OF SECTION

SECTION 26 32 16
DUAL PURPOSE MANUAL TRANSFER SWITCHES WITH INTEGRATED LOAD BANK AND
GENERATOR QUICK CONNECTS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install manual transfer switches with 4-poles, amperage, voltage, and withstand current ratings as shown on the plans or as required. Each manual transfer shall consist of a 3-position center off mechanically held power transfer switch unit and a mechanical operating mechanism to provide complete manual operation. Each manual transfer switch shall include integrated load bank and generator quick disconnects. All manual transfer switches and mechanical operating mechanism shall be the product of the same manufacturer.

1.2 RELATED DOCUMENTS

- A. The Conditions of the Contract and applicable requirements of Division 1 and Section 26 05 00 govern this Section.

1.3 Acceptable Manufacturers

- A. Basis of design: ASCO Series 300.
- B. Alternate manufactures:
 - 1. Trystar
 - 2. PSI Power and Controls

1.4 Codes and Standards

The manual transfer switches and accessories shall conform to the requirements of:

- A. UL 1008 Listed for Optional Standby Transfer Switches (Manual Transfer Switches)
- B. UL 891 Switch Boards
- C. CSA C22.2 No.178 –1978
- D. EC 60947-6-1 Low – Voltage Switchgear and Controller
- E. PA 70 - National Electrical Code
- F. FPA 99 – Essential Electrical Systems for Health Care Facilities
- G. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
- H. UL 508 Industrial Control Equipment
- I. NEC Article 700
- J. International Standards Organization ISO 9001
- K. RoHs compliant (Restriction of Hazardous Substances)
- L. Seismic qualification – International Building Code & OSHPD to SDS level of 2.5

1.5 QUALITY ASSURANCE

- A. NEC and NFPA Compliance: Comply with applicable portions of the NEC (NFPA 70) including, but not limited to, emergency and standby power generation systems.
- B. IEEE Compliance: Comply with applicable Institute of Electrical and Electronics Engineers, Inc. (IEEE) standards pertaining to generator construction.
- C. Supplier: All equipment provided shall be supplied by an authorized distributor of the manufacturer who has been continuously engaged in the distribution of industrial grade Power System products for a minimum of 10-years. The supplier shall provide initial start-up services, conduct field acceptance testing, and warranty service. The supplier is to be authorized to perform warranty service on all products provided.

1.6 SUBMITTALS

SALAS O'BRIEN

DUAL PURPOSE MANUAL TRANSFER SWITCHES WITH
INTEGRATED LOAD BANK AND GENERATOR QUICK CONNECTS

26 3216-1

Salas O'Brien Registration #F-4111

- A. Submittal drawings and information on the manual transfer switches including installation drawings, wiring diagrams, dimensions, weights, etc. shall be provided. Full descriptive information on accessory items shall be furnished. Indicate:
 - 1. Detailed dimensions for equipment footprint, front, rear, and side elevations.
 - 2. Conduit entrance locations and requirements and restrictions.
 - 3. Enclosure material, finish, and NEMA classification type.
 - 4. Nameplate legends.
 - 6. Metering and control wiring details.
 - 7. Electrical characteristics including voltage, ampacity, overcurrent device frame size and trip ratings, withstand ratings, and time current curves of all overcurrent devices and components.
- B. Submit manufacturers' "Installation, Start-Up and Service" instructions, recommended conductors, overcurrent protection, and electrical interlocks.
- C. Submit recommended clearance dimensions.
- D. Submit sequence of operation in narrative form.
- E. Instruction Data and Drawings: Commercial type operating instructions shall be provided consisting of operating and maintenance manuals, parts books, dimensional drawings, and wiring diagrams.

1.7 WARRANTY

- A. Provide one-year parts and labor warranty from date of substantial completion.

PART 2 - PRODUCTS

2.1 Mechanically Held Transfer Switch

- A. The manual transfer switch unit shall be manually operated and mechanically held. The switch shall be mechanically interlocked to ensure only one of three possible positions, Source 1, Source 2, or Center Off. Fused disconnect type switches shall not be acceptable.
- B. The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.
- C. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented blow-on construction for high withstand current capability and be protected by separate arcing contacts.
- D. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors.
- E. Transfer switch designs utilizing components of molded-case circuit breakers, contactors, or parts thereof which are not intended for continuous duty, repetitive switching, or transfer between two active power sources are not acceptable.
- F. Neutral conductors shall be switched to electrically isolate the permanent generator from the temporary generator. The manual transfer switch shall be provided with fully-rated neutral transfer contacts.
- G. The manual transfer switch shall be tested in accordance with UL 1008 for transfer switches. Switch ratings of 260 Amperes and less shall have endurance rating of 6000 cycles, 400 Ampere shall have endurance rating of 4000 cycles, and 600 – 3000 Amperes shall have endurance rating of 3000 cycles.

2.2 MANUAL OPERATIONS PROVISIONS

- A. The manual transfer switch shall be arranged for manually actuated manual operation.
- B. The manual transfer shall be actuated via a mechanical operating mechanism.
- C. The manual operating handle shall be capable of external operation without opening the enclosure door.
- D. It shall have the same contact to contact speed as would be for automatic operation.

- E. There shall be three positions for manual operation:
 - 1. Connected to Source 1 (preferred)
 - 2. Connected to Source 2 (alternate)
 - 3. Connected to center off (disconnected position)
- F. Switch position when connected to Source 1, or Source 2 shall be pad – lockable.

2.3 ENCLOSURE

- A. Manual transfer switches located outdoors shall be furnished in a NEMA type 3RX type 316 stainless steel enclosure. Manual transfer switches located indoors shall be NEMA 3R.
- B. Enclosures shall be wall mounted or free-standing floor or pad mounted.
- C. NEMA 3R enclosures shall be code gauge steel as per UL 50 with ANSI #61 powder coat finish.
- D. 3RX enclosures shall be 316 stainless steel.
- E. Provide strip heater with thermostat for Type 3R and 3RX enclosure requirements.

2.4 MECHANICAL AND ELECTRICAL PERFORMANCE

- A. Mechanical position indicators (yellow) visible to the operator shall be included for Source 1 (preferred), Source 2, (alternate), and Center Off (disconnected).
- B. Auxiliary position indicating contacts, rated 10 amps, 250 Vac shall be provided consisting of one closed when the manual transfer switch is connected to Source 1 (preferred), and one contact closed when the manual transfer switch is connected to Source 2 (alternate).
- C. A form A contact shall be provided to indicate switch is in the Center Off (disconnected) position.
- D. A Load Dump disconnect circuit breaker shall be provided between source 1 of the manual transfer switch and the 16 Series Outlets for Load Bank Connection. Load Dump circuit breaker shall include shunt trip and be sized for the full rating of the manual transfer switch and capable of carrying, at minimum, the full kW rating of the permanent generator for a minimum of 4-hours. Provided ground fault (GFI) protection for circuit breakers rated 800 Amperes or larger. Load dump disconnect circuit breaker shall be Square D, or the same manufacture as the building's main service disconnect equipment.
- E. Auto Start Destination Toggle Switch shall be provided to allow for the user to select which generator the ATS will start when the engine start signal is sent from the building automatic transfer switch.
- F. The Dual-Purpose Manual Transfer Switch integrated quick connects shall provide a connecting means for connecting a portable generator or a load bank.
- G. Generator quick connects:
 - 1. For 400A and below models, there shall be one (1) row of up to five (5) single pole connections.
 - 2. For 600A - 800A models, there shall be two (2) rows of up to five (5) single pole connections.
 - 3. For 1000A-1200A models, there shall be three (3) rows of up to 5 single pole connections.
 - 4. For 1600A models, there shall be four (4) rows of up to 5 single pole connections.
 - 5. For 2000A models, there shall be five (5) rows of up to 5 single pole connections.
 - 6. For 2500A models, there shall be seven (7) rows of up to 5 single pole connections.
 - 7. For 3000A models, there shall be eight (8) rows of up to 5 single pole

- connections.
- H. Neutral connections are not required for Load Bank connections:
1. For 400A and below models, there shall be one (1) row of up to four (4) series single pole connections.
 2. For 600A - 800A models, there shall be two (2) rows of up to four (4) single pole connections.
 3. For 1000A-1200A models, there shall be three (3) rows of up to four (4) single pole connections.
 4. For 1600A models, there shall be three (3) rows of up to 4 single pole connections.
 5. For 2000A models, there shall be five (5) rows of up to 4 single pole connections.
 6. For 2500A models, there shall be seven (7) rows of up to 4 single pole connections.
 7. For 3000A models, there shall be eight (8) rows of up to 4 single pole connections.
- I. All electrical quick connectors shall be 16 Series cam type single pole connectors; color coded as per local industry standard practice:
1. 240V and below: phase 1 = black, phase 2 = red or orange for hi-leg, phase 3 = blue (if required).
 2. 480V: phase 1 = brown, phase 2 = purple or orange, phase 3 = yellow.
 3. Ground shall always be green.
 4. Neutral shall always be white.
 5. A minimum of 25% phase ampacity shall be provided for ground connections for portable generator and load bank connections.

2.5 ACCESSORIES

- A. Enclosure Heater(s): A 125-watt enclosure heater with transformer and thermostat (adjustable from 30° to 140 degrees F) shall be provided for outdoor installations where type 3R or 3RX, enclosures are specified. (This feature shall be equal to ASCO accessory 44G and shall be capable of being added to existing switches). Thermostat shall be set to 40-degrees F.
- B. Surge Suppression – A SPD with a surge current rating of 65kA shall be provided with individually matched fused metal oxide varistors (MOVs). It shall include LED status indication of normal operation, under voltage, power loss, phase loss or component failure. Shall include form C dry contacts for external alarm or monitoring. The unit shall be enclosed in a Noryl housing rated NEMA 4, 12, and 4X. Shall comply with UL 1449 latest edition. (This feature shall be equal to ASCO accessory 73).
- C. Shunt Trip Option on the Load Bank Breaker- 119LC - 24VDC Shunt Trip on the manual transfer switches load bank breaker to integrate with building automatic transfer switch. Load dump upon loss of utility source or automatic generator start signal from the automatic transfer switch. Circuit breakers 800 Amps and larger shall include GFI, Ground Fault Interrupter.
- D. Power Meter - ASCO 5210 Power Meter Connected to Load Side (135L)
- E. Accessory 171EP Base Package Bundle – Two form C contacts shall be connected to a terminal block that operate when Source 1 and Source 2 voltage is present at manual transfer switch terminals. The following indicators shall be provided:
1. Load Connected to Source 1 (Green).
 2. Load Connected to Source 2 (Red).
 3. Source 1 Available (Green).
 4. Source 2 Available (Red).
 5. Load Disconnect (Yellow)
 6. Phase Rotation Monitor
 7. Maintained Engine Start Switch and Common Alarm LED/Contact

2.6 WITHSTAND AND CLOSING RATINGS

A. The Manual Transfer Switch shall be rated to close on and withstand the available RMS symmetrical short circuit current at the terminals with the type of overcurrent protection shown on the plans.

1. Source 1 WCR ratings @ 480v shall be as follows when used with specific circuit breakers or current limiting fuses:

MTDQ Size	Source 1 Withstand & Closing Rating MCCB	Source 1 W/CLF
150A - 600A	50,000A	200,000A
800A - 1200A	50,000A	200,000A
1600A - 2000A	65,000A	200,000A
2500A - 3000A	100,000A	200,000A

2. Source 2 WCR ratings @ 600V shall be as follows when used with any molded case circuit breaker:

MTDQ Size	Source 2 Withstand & Closing Rating MCCB at Source Wired to Quick Connects
105A - 600A	22,000A
800A - 1200A	22,000A
1600A - 2000A	65,000A
2600A - 3000A	100,000A

2.7 TESTS AND CERTIFICATION

- A. The manual transfer switch shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure compliance with the specification requirements.
- B. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.
- C. The manual transfer switch manufacturer shall be certified to ISO 9001: 2008 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation and servicing in accordance with ISO 9001: 2008.

2.8 SERVICE REPRESENTATION

- A. The manual transfer switch manufacturer shall maintain a national service organization of company- employed personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.
- B. The manufacturer shall maintain records of switch shipments, by serial number, for a minimum of 20 years.
- C. For ease of maintenance, the manual transfer switch nameplate shall include drawing numbers and serviceable part numbers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install manual transfer switches where shown, in accordance with the equipment manufacturer's written instructions and recognized industry practices to ensure that the transfer switch complies with the specified requirements and serve the intended purposes. Provide and install complete operating instructions in a Plexiglas enclosure for each type of transfer switch inside the enclosure.
- B. Standard: Comply with NEMA standards, requirements of the NEC, and applicable portions of NECA Standard of Installation pertaining to installation of manual transfer switches.
- C. Concrete Pad: Install free-standing floor or pad mounted manual transfer switches on a reinforced concrete pad. The pad shall extend 6" beyond the manual transfer switch base, unless shown otherwise. Furnish the exact position of any block outs, mounting bolts, and the dimensions and location of the manual transfer switch pad in a timely manner so as to prevent delay of the concrete work. Refer to Section 26 05 00 for housekeeping pads and Division 3 for Concrete Work.
- D. Provide circuits, conductors, and raceways as required for manual transfer switch options and accessories as required or specified. Provide separate dedicated circuits from the emergency branch circuit panel board to the manual transfer switch when required for indicated options or accessories. Provide control circuits from building automatic transfer switch to load bank shunt trip circuit breaker for load bank dump upon loss of building utility power.
- E. Provide shunt trip control of load bank circuit breaker to dump the load bank load if the building automatic transfer switch loses utility power.

3.2 GROUNDING

- A. Ground the manual transfer switch to the building grounding system and provide a driven ground electrode at the manual transfer switch location or bond to the building grounding system ground rod(s) if in close proximity.

3.3 CONTROLS

- A. Provide manual transfer switch load dump control wiring and raceway from the automatic transfer switch to the load bank shunt trip circuit breaker to dump the load bank load upon generator start signal from the building automatic transfer switch(es).

3.4 TESTING

- A. Notify Owner's Commissioning Authority (CxA) prior to performing any tests so the CxA may witness tests at his/her discretion. Refer to Section 26 01 00 Commissioning of Electrical Systems. Testing shall be witnessed by owner and Engineer.
- B. Coordinate testing of manual transfer switch with the testing of the permanent generator source and associated automatic transfer switches, including the generator load bank test.
- C. Contractor shall furnish all instruments, load banks, and personnel required for test. Submit 4 copies of certified test results to Architect/Engineer for review. Test reports shall include date and time of test, relative humidity, temperature, and weather conditions.
- D. Pre-energization checks: Before energizing, check for continuous of circuits and for short circuits.
- E. Ground Fault Interrupter (GFI) test for load bank circuit breakers 1,000 Amps and larger: After completion of construction and before final acceptance testing, the ground fault protection system shall be field-tested and reset to the manufacturer's settings for both current and time by a representative of the manufacturer's engineering service department. After the test, set ground fault to 20 percent of overcurrent device rating or 600 Amperes, whichever is lower.
- E. Provide thermal infrared scan of the manual transfer switch under full load as directed

and witnessed by Owner. Correct any deficiencies causing abnormal heating and repeat the scan. Provide digital video documentation with deficiencies corrected for comparison to future test. Make corrections as needed as soon as possible as directed by the Owner. Repeat the scan at the 11-month prior to close out and make corrections prior to close-out.

- F. Submittals: Furnish instruments and personnel required for tests. Submit 4 copies of certified test results to the Architect for review. Test reports shall include switchboard tested, date and time of test, relative humidity, temperature, and weather conditions.

3.5 TRAINING

- A. Provide four hours training, one hour each for four persons, four separate days. Coordinate with the Owner for manual transfer switch training which may coincide with any other related or required generator or automatic transfer switch training.

END OF SECTION

SECTION 26 3600
NEW AUTOMATIC TRANSFER SWITCHES
(Connected to Existing Emergency Generator)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Conditions of the Contract and applicable requirements of Division 1 and Section 26 05 00 govern this Section.

1.2 WORK INCLUDED

- A. Furnish and install new automatic transfer switches, complete with wiring and controls as shown on the drawings and as specified herein.

1.3 QUALITY ASSURANCE

- A. Acceptable Manufacturers:
 - 1. Onan/Cummins/Southern Plains Power. Match existing manufacturer.
- B. NEC and NFPA Compliance: Comply with applicable portions of the NEC (NFPA 70) including, but not limited to, emergency and standby power generation systems (NFPA 99 & 110).
- C. IEEE Compliance: Comply with applicable Institute of Electrical and Electronics Engineers, Inc. (IEEE) standards pertaining to automatic transfer switches.
- D. Supplier: Authorized distributor of specified manufacturer with minimum three years documented experience.

1.4 AUTOMATIC TRANSFER SWITCH WARRANTY

- A. Provide two-year parts and labor warranty from date of substantial completion. Provide an additional three year parts warranty after the second year.

1.5 SUBMITTALS

- A. Submit manufacturer's certified computer generated performance and capacity data in accordance with specification requirements.
- B. Submit manufacturer's Installation, Start-Up and Service instructions.
 - 1. Recommended conductors, overcurrent protection and disconnect size.
 - 2. Electrical interlocks.
- C. Submit recommended clearance dimensions.
- D. Submit internal wiring diagram of Control Center.
- E. Submit sequence of operation in narrative form.

PART 2 - PRODUCTS

2.1 AUTOMATIC STARTING SEQUENCE OF EVENTS

- A. Sequence of Events:
 - 1. Upon drop in normal source voltage to 65 to 70% of rated voltage, or upon failure of the normal source of electrical supply, the engine shall be automatically cranked and brought up to the full operating speed.
 - 2. The cranking motor circuit shall be instantly broken when the engine starts.
 - 3. Within 10 seconds the generator shall be brought up to operating speed; the generator voltage shall operate the automatic transfer switch, disconnecting the load from the normal source of supply and connecting the emergency power to the load.
 - 4. Upon restoration of the normal source voltage to 92 to 95% of rated voltage or restoration of normal source of supply, the sequence shall be reversed, restoring the transfer switch to the automatic normal operating position, disconnecting the load from the emergency generator and reconnecting the load to the normal source of supply. The emergency generator set will continue to operate for a

period of from 1 to 5 minutes after the restoration of the normal source of supply. Should the engine fail to start upon the first crank, there shall be two additional cranking attempts made with a 15 second rest between cranks, after which the cranking cycle shall cease and an alarm shall sound to indicate malfunctioning of the system.

- B. Instruction Data and Drawings: Commercial type operating instructions shall be provided consisting of operating and maintenance manuals, parts books, dimensional drawings and wiring diagrams. Three copies of dimensional drawings and wiring diagrams shall be provided as specified.
1. Operating Instructions: Provide and install in a suitable enclosure operating instructions for the automatic transfer switch.

2.2 AUTOMATIC TRANSFER SWITCHES

- A. Rating and Construction:
1. Refer to the project drawings for specifications on the sizes and types of transfer switch equipment, withstand and closing ratings, voltage and ampere ratings, and accessories. All transfer switches have switched neutrals and shall be electrically operated and mechanically held.
 2. All transfer switches and accessories shall be UL listed and labeled, tested per UL Standard 1008, and CSA Approved, and comply with NEMA ICS 2-447. When protected by molded case breaker withstand and closing ratings shall not be less than the following RMS symmetrical amps at 600 VAC:

Switch Size in Amps	WCR @ 480 Volts
Up to 125	22,000
150 to 260	30,000
300 to 400	65,000
600 to 800	65,000
1000 to 1200	100,000
1600 and larger	100,000

3. Provide one of the following standard products:
 - a. Onan OTEC or OTPC Series as required
 - b. Standby Generator System Manufacturer, provided as a complete system
4. Electrical operation shall be accomplished by a momentarily energized single solenoid operating mechanism, which receives power from the source to which the load is being transferred. Fuse or thermal protection of the main operator is prohibited. The operating transfer time shall be 1/6 of a second or less. Mechanical locking in each position shall be accomplished without the aid of permanent magnets, latching solenoid, or motor operators.
5. Operation shall be inherently double-throw whereby all contacts move simultaneously and with no programmed delay in a neutral position. Electrical spacing shall be equal to or exceed those listed in table 15.1 of UL 1008. Only those main contact structures specifically manufactured for transfer switch service shall be acceptable. An overload or short circuit shall not cause the switch to go to a neutral position.
6. Inspection of all contacts (movable and stationary) shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The maintenance handle shall permit the operator to stop the contacts at any point throughout the entire travel to properly inspect and service the contacts when required.
7. All switches shall have fully rated neutral transfer contacts that momentarily interconnect the neutrals of the sources and load for 100 milliseconds maximum, during the transfer / retransfer operation. The neutrals shall remain so

- interconnected until the line contacts close on the alternate source. Line and neutral contacts shall be driven by a single main operator.
8. Enclosure shall be NEMA Type 12, indoor use, dust tight and drip-tight.
- B. Controls and Accessories:
1. Controls shall provide for the automatic starting sequence of the generator set.
 2. Automatic controls shall signal the engine-generator set to start upon signal from normal source sensors. Solid-state time delay start, adjustable from 0 to 5 seconds (factory set at 2 seconds) shall avoid nuisance start-ups. Battery voltage starting contacts shall be gold, dry type contacts factory wired to a field wiring terminal block.
 3. The switch shall transfer when the emergency source reaches the set point voltage and frequency. Provide a solid-state time delay on transfer, adjustable from 0 to 120 seconds.
 4. The switch shall retransfer the load to the normal source after a time delay retransfer, adjustable from 0 to 30 minutes. Retransfer time delay shall be immediately bypassed if the emergency power source fails.
 5. Control shall be solid state and designed for a high level of immunity to power line surges and transients, demonstrated by test to IEEE Standard 587-1980. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs, and relays on all outputs. Control shall be quick-disconnect for ease of service.
 6. Automatic transfer switches shall have inherent phase balance protection logic to detect a 'single phasing' Solid state undervoltage sensors shall simultaneously monitor all phases of both sources. Pick-up and dropout settings shall be adjustable. Voltage sensors shall allow for adjustment to sense partial loss of voltage on any phase. Voltage sensors shall have field calibration of actual supply voltage to nominal system voltage. The transfer switch controller shall be equipped with a fault output terminal interconnected to a 24Vdc shunt trip, integral to the transfer switch and with built-in time delay, that functions to disconnect the utility source from the load should the standby emergency source fail to start.
 7. Controls shall signal the engine-generator set to stop after a time delay, adjustable from 0 to 10 minutes, beginning on return to the normal source.
 8. Power for transfer operation shall be from the source to which the load is being transferred.
 9. The control shall include latching diagnostic indicators to pinpoint the last successful step in the sequence of control functions, and to indicate the present status of the control functions in real time.
 10. The control shall include provisions for remote transfer inhibit and area protection.
 11. Provide front panel devices mounted on cabinet front consisting of:
 - a. A key operated selector switch to provide the following positions and functions:
 - 1) Test - Simulates normal power loss to control for testing of generator set. Controls shall provide for a test with or without load transfer. Refer to Part 3 for programming requirements.
 - 2) Normal - Normal operating position.
 - 3) Retransfer - Momentary position to override retransfer time delay and cause immediate return to normal source, if available.
 12. Exerciser Clock: Provide solid state exerciser clock to set the day, time, and duration of generator set exercise/test period. Provide a with/without load selector switch for the exercise period. Refer to Part 3 for programming requirements.
 13. Provide Phase Sequence Monitor/Balance Module to protect against inadvertent

- phase rotation hookup and monitor for voltage phase imbalance between phases.
14. Submittals:
- a. Submittal drawings and information on the transfer switches including installation drawings, wiring diagrams, dimensions, weights, etc. shall be provided. Full descriptive information on accessory items shall be furnished. All submittals shall be reviewed by the Engineer and approved prior to fabrication.
15. Instruction Data and Drawings:
- a. Commercial type operating instructions shall be provided consisting of operating and maintenance manuals, parts books, dimensional drawings and wiring diagrams. Three copies of each are to be furnished per Contract Closeout specifications.
 - b. Operating Instructions: Provide and install in a plexiglass enclosure complete operating instructions for each type of transfer switch.

2.3 ELECTRICAL AND MECHANICAL PERFORMANCE

- A. The switch must comply with UL 1008 and NEMA Standard Publication ICS 2-447. In addition, the switch must meet or exceed the following requirements and if so requested, be verified by certified laboratory test report.
1. Temperature Rise: Measurements shall be made after the overload and the endurance tests.
 2. Withstand: UL listed to withstand the magnitude of fault current available at the switch terminals when coordinated with respective protective devices at an X/R ratio of 6.6 or less. The main contacts of the transfer switch shall not trip open or weld when subjected to fault currents.
 3. Dielectric: Test, following the withstand current rating test, at 1960 volts AC rms minimum.
 4. Transient Withstandability: Control panel voltage surge withstand capability test per IEEE Standard 472-1974 and voltage impulse withstand test per NEMA Standard publication ICS-1-109.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install automatic transfer switch where shown, in accordance with the equipment manufacturer's written instructions and recognized industry practices, to ensure that the automatic transfer switch complies with the specified requirements and serve the intended purposes.
- B. Standard: Comply with NEMA standards, requirements of the NEC, and applicable portions of NECA Standard of Installation pertaining to installation of standby engine-driven generator sets and accessories.
- C. Options and Accessories: Provide circuits, conductors, and raceways as required for options and accessories as specified.
- D. Provide dry contacts and outputs to monitor transfer switch and generator alarm conditions and notify Owner's Police or security personnel, and building management controls system and personnel, both when transfer to emergency occurs and when transfer to normal occurs.

3.2 GROUNDING

- A. Install the generator automatic transfer switch as a non-separately derived system. Do not ground the generator neutral to the generator frame. Ground the generator frame to the building grounding system.

3.3 CONTROLS

- A. Provide generator start-up control wiring and raceway from each automatic transfer switch to the respective standby generator set as required.

3.4 TESTING

- A. Provide testing in accordance with NFPA 110. Provide manufacturer's start-up service to test emergency power system to demonstrate standby capability and compliance with specified requirements, including automatic start-up, controls and full load acceptance. Test shall include operation of standby power system with voltage check while the system is loaded to ensure proper operation of the emergency generator, transfer switches, and other system components. Operation of the system shall simulate standby power conditions, that is, loss of main electrical power to the building. Test period shall be trouble-free operation with at least four automatic transfer switch operations (each switch) within the period of operation.
 - 1. The generator shall be started cold and run for a four-hour test with building load connected and load bank to achieve 90 percent of rated generator capacity. Monitor and record available natural gas pressure and verify supply is adequate and stable during the entire test.
 - 3. Retransfer the load after test.
 - 4. After this test, the set shall cool for five minutes, then must start and carry 90% rated capacity load for four hours.
 - 5. Provide additional Owner witnessed testing for all ancillary equipment on generator. Demonstrate all specified functions and alarms.
 - 6. Demonstrate the cranking cycle and all engine safety devices. The Owner's authorized representative shall be instructed in the operation and maintenance of the unit. Provide minimum 4-hours training at each campus for 4-persons; one hour on four separate days
- B. Provide separate written inspection report by manufacturer's factory representative regarding existing condition and/or deficiencies regarding the existing diesel generator operation.
- C. Contractor shall furnish all instruments and personnel required for test. Submit 4 copies of certified test results to Architect/Engineer for review. Test reports shall include date and time of test, relative humidity, temperature and weather conditions.
- D. Upon completion of all tests, Contractor shall notify the Owner / Architect in writing the fuel level of the existing fuel tank if generator is fueled by diesel.

3.5 MISCELLANEOUS

- A. Provide circuits and receptacles to serve loads as directed by Owner / Architect, including, but not limited to:
 - 1. Telecommunications equipment
 - 2. Public Address Communication & Master Clock System
 - 3. Fire Alarm, Detection and Signaling Systems
 - 4. Security Systems (except for battery powered access control door hardware)
 - 5. Video Surveillance CCTV System including remote camera power supplies
 - 6. Technology/Computer data MDF/IDF equipment
 - 7. MDF/IDF dedicated HVAC equipment
 - 8. Selected refrigeration equipment
 - 9. Clinic refrigerator and selected clinic receptacles
 - 10. Building Access control System including remote power supplies, except do not power door electric strike or hinge hardware on emergency power.
 - 11. Owner's Radio Base Station / Radio Repeaters / Distributive Antennae System (DAS)
 - 12. Elevator
 - 13. Point of Sale Stations

14. Kitchen Manager's Work Station
15. Building Management and Control System (BMCS)
16. Special education receptacles, one in each room.
17. First responder Bi-Directional Distributive Antennae System (DAS) Systems

3.6 PROGRAMMING

- A. Program automatic transfer switches for delayed transfer to emergency and sequential operation to transfer loads by priority based on manufacturer recommendation or as indicated below:
 1. Life Safety Loads – less than 10 seconds
 2. Critical Loads – more than 15 seconds, less than 30 seconds
 3. Equipment Loads – more than 40 seconds, less than 60 seconds
 4. Non-Legally required loads – more than 75 seconds, less than 120 seconds
- B. Program automatic transfer switch voltage and frequency pick-up and drop out for load shedding based on load priority for voltage and frequency based on manufacturer recommendations or as indicated below:
 1. Life Safety pick-up 10%; drop out 20%
 2. Critical Loads pick-up 10%; drop out 15%
 3. Equipment Loads pick-up 8%; drop out 15%
 4. Non-Legally required loads pick-up 5%; drop out 10%
- C. Exerciser clock (if this transfer switch is the transfer switch to exercise the generator): Program automatic transfer switch exerciser clock for generator to run every Tuesday, 8:00 AM, for 30-minute run time, without load. Verify with Owner.
- D. Test switch: Program automatic transfer test switch for generator to run with load, for maximum 30-minute test time plus cool-down. Verify with Owner.

3.7 TRAINING

- A. Provide 2 hours training, one hour each for four persons, four separate days.

END OF SECTION

SECTION 26 4300
SURGE PROTECTION DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Surge Protection Device (SPD) covered under this section includes service entrance type surge protection devices suitable for use as Type 1 or Type 2 Devices per UL1449 5th Edition, applied to the line or load side of the utility feed inside the facility. SPDs shall be connected in parallel with the facility's wiring system. The unit shall be manufactured in the USA by a qualified manufacturer of suppression filter system equipment, which has been engaged in the commercial design and manufacture of such products for a minimum of five years.
- B. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified and required to finish and install surge protection devices.

1.2 QUALITY ASSURANCE

- A. Reference Standard: Comply with the latest edition of the applicable provisions and recommendations of the following, except as otherwise stated in this document:
 - 1. UL 1449 Fifth Edition
 - 2. ANSI/IEEE C62.41, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
 - 3. ANSI/IEEE C62.45, Guide for Surge Testing for equipment connected to Low-Voltage AC Power Circuits.
 - 4. IEEE 1100 Emerald Book.
 - 5. National Fire Protection Association (NFPA 70 (NEC), 75, and 78).
 - 6. UL 1283 – Electromagnetic Interference Filters
- B. When requested for verification, provide copies of the following:
 - 1. Copies of actual let through voltage data in the form of oscilloscope results for both ANSI/IEEE C62.41 Category C3 (combination wave) and B3 (Ring wave) tested in accordance with ANSI/IEEE C6245.
 - 2. Copies of test reports from a recognized independent testing laboratory, capable of producing 200kA surge current waveforms, verifying the suppressor components can survive published surge current rating on both a per mode and per phase basis using the ANSI/IEEE C62.41 impulse waveform C3 (8 x 20 microsecond, 20kV/10kA). Test data on an individual module is not acceptable.

1.3 SUBMITTALS

- A. Submit shop drawings complete with all technical information for specific unit dimensions, let through voltage data, detailed installation instructions, maintenance manual, and wiring configuration.
- B. Provide detailed marked-up copy of this specification with line-by-line compliance or exception statements to all provisions of this specification.
- C. Copies of Manufacturer's catalog data, technical information and specifications on equipment.
- D. Copies of documentation stating that the Surge Protection Device is listed from a Nationally Recognized Testing Laboratory (NRTL) (UL, ETL, etc.) and are tested and multi-listed to UL 1449 5th Edition and UL 1283.
- F. Copy of warranty statement clearly establishing the terms and conditions to the building/facility owner/operator.

1.4 WARRANTY

- A. The manufacturer shall provide a minimum 20-year warranty for high and very high exposure SPDs. Very high exposure unit warranties shall include exposure to temporary extended over-voltage conditions. Provide a minimum 15-year warranty for all medium

exposure SPDs, and a minimum 10-year warranty for all other SPDs for parts from date of substantial completion against failure. Contractor shall assist the Owner with manufacturer warranty registration.

PART 2 – PRODUCTS

2.1 APPROVED MANUFACTURER

- A. Low exposure, minimum 10-year parts warranty, minimum 50k Amps per mode, 100k Amps per phase, Type 1 and Type 2.
 - 1. Recessed mount panelboard extension with brushed stainless-steel front:
 - a. ACT Communications:471- ###V-050-SS-F-PB flush series.
 - b. ABB Current Technology PX3-050-VVV- #X-SF-X-F- # series.
 - c. SSI Surge Suppression, Inc. CSMx12-FMPxSS series.
 - d. SST Southern Tier Technologies T45-VVVV-50-AWAJ2-C-RKSS(Stainless Steel front).
 - 2. Branch panelboard surface mounted:
 - a. ACT Communications 455 series.
 - b. ABB Current Technology CG3 60 series.
 - c. SSI Surge Suppression, Inc. CSMx12 series.
 - d. SST Southern Tier Technologies T45-VVVV-50AWAJ2-C
- B. Medium exposure, minimum 15-year parts warranty, minimum 120k Amps per mode, 240k Amps per phase, Type 2.
 - 1. ACT Communications 471 series.
 - 2. ABB Current Technology CGP3 125 series.
 - 3. SSI Surge Suppression, Inc. CSMx24 series.
 - 4. SST Southern Tier Technologies T45-VVVV-120A series
- C. High exposure, minimum 20-year parts warranty, minimum 200k Amps per mode, 400k Amps per phase, Type 2 SPD.
 - 1. ACT Communications 471 x200 series.
 - 2. ABB Current Technology TG3 200 series.
 - 3. SSI Surge Suppression, Inc. CHLxM series.
 - 4. SST Southern Tier Technologies T45-VVVV-200A series
- D. Very high exposure at service entrance 1,201 Amps and above: Minimum 20-year parts warranty; minimum 200k Amps per mode; 400k Amps per phase, Type 1 and 2 SPD:
 - 1. ACT Communications 471 x200 SEL series.
 - 2. ABB Current Technology SEL3 200 series.

The service entrance protector shall incorporate a combination of TPMOV and Selenium technology allowing for transient surge and temporary over voltage protection. The unit shall be able to prevent common temporary over voltages and high impedance faults from damaging the MOVs, increasing their longevity and ability to protect the critical load. Limited and Intermediate current TOVs can be caused by a loss of the neutral conductor in a split phase or three phase power system. The available fault current will be determined by the impedance of the loads connected to the phases opposite the SPD and are typically in the range of 30A to 1000A. Minimum 20-year parts warranty, extended over-voltage protection, minimum 200k Amps per mode, 400k Amps per phase, Type 2 SPD. The Selenium elements must limit voltage to the MOV as a percent of nominal as outlined below:

Overvoltage seen by MOVs as % of Nominal				
	available current			
time	30A	100A	500A	1000A
1 cycle	120%	130%	150%	160%
10 cycles	130%	150%	160%	160%
30 cycles	140%	150%	160%	160%

*To verify damage to the MOVs has been mitigated, the percent overvoltage seen at the MOV must be less than 200% for split-phase applications or 173% for three-phase applications (100% is nominal).

2.2 MANUFACTURED UNITS / ELECTRICAL REQUIREMENTS

- A. Declared Maximum Continuous Operating Voltage (MCOV) shall be greater than 115 percent of the nominal system operating voltage and in compliance with test and evaluation procedures outlined in the nominal discharge surge current test of UL1449, section 37.7.3. MCOV values claimed based on the component's value or on the 30-minute 115% overvoltage test in UL1449 will not be accepted.
- B. Unit shall have not more than 10% deterioration or degradation of the UL1449, Voltage Protection Rating (VPR) due to repeated surges.
- C. Protection Modes SVR (6kV, 500A) and UL1449 VPR (6kV, 3kA) for grounded WYE/delta and High Leg Delta circuits with voltages of (480Y/277), (208Y/120), (600Y/347). 3-Phase, 4 wire circuits, (120/240) split phase shall be as follows and comply with test procedures outlined in UL1449: Values Depicted are based on a system Without Disconnect / With Disconnect

System Voltage	Mode	MCOV	C3 Wave	UL 1449 VPR Rating
120/240	L-N	150	650/775	700/800
120/208	L-G	150	650/825	700/900
	N-G	0	500/500	900/1000
	L-L	300	950/1250	900/1200
277/480	L-N	320	1125/1225	900/1200
	L-G	320	1075/1225	1200/1200
	N-G	0	900/900	1200/1500
	L-L	550	1950/2200	1800/1800

- D. Electrical Noise Filter- each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric noise shall be as follows using the MIL-STD-220A insertion loss test method.
 1. 14 dB from 10 kHz to 1 MHz.
- E. Each Unit shall provide the following features:
 1. Phase Indicator lights, Form C dry contacts, counter and audible alarm.
 2. Field testable while installed.
 3. High performance interconnecting cable.
 4. The UL 1449 Voltage Protection Rating (VPR) shall be permanently affixed to the SPD unit.
 5. The UL 1449 Nominal Discharge Surge Current Rating shall be 20kA
 6. The SCCR rating of the SPD shall be 200kAIC without requiring an upstream protection device for safe operation.
 7. The unit shall be listed as a Type 2 SPD per UL1449.
 8. Power wiring: SPD shall be equipped with mechanical lugs that can accept up to #2 AWG wire on High Exposure units and up to #6 on Medium and Low Exposure units.

2.3 POWER CABLES FOR CONNECTION

- A. Power wiring: Conductors between all high and very-high SPDs and switchgear shall be high performance interconnect system "Low Z Cable" cables with Ultra Low impedance

- characteristics at 10kHz and above.
- B. High Performance Low Impedance cable shall be #6 AWG minimum for Very High, High, and Medium Exposure SPDs and #10 AWG minimum for Low Exposure SPDs.

PART 3 – EXECUTION

3.1 GENERAL INSTALLATION

- A. The unit shall be installed as close as practical to the facility's wiring system in accordance with applicable national/local electrical codes and the manufacturer's recommended installation instructions. Connection shall be with high performance, low impedance cables in conduit and shall not be any longer than necessary, avoiding unnecessary bends. Minimum wire size and overcurrent protection device for disconnect shall be provided and as recommended by the manufacturer.
- B. Units specified for lighting and appliance panel boards as panelboard extensions (EGPE) shall be mounted directly above or below the first section of the panel board it is protecting. Any other mounting location will not be acceptable and shall be corrected, without exception, at no additional cost to the Owner.
- C. Units specified for panelboards, switchboards, or motor control centers shall be mounted directly above or adjacent to the panelboard, switchboard or motor control center using unistrut supports secured to structure as required. Conduit length between power distribution panelboard or switchboard shall be less than two inches. Mounting above equipment is not acceptable.
- D. Overcurrent device and conductors for devices shall be the maximum recommended by the manufacturer. Manufacturer's recommendations shall prevail over the information given in the plans and specifications.
- E. Provide recessed mounted panelboard extension type enclosures for devices protecting recessed panelboards. Enclosure front shall match panelboard front material and finish. Provide brushed stainless-steel front at kitchens and food processing areas.

3.2 UNIT SELECTION BASED ON EXPOSURE LEVEL

- A. (SPDVH) Provide very-high exposure SPDs with Selenium and TPMOV technology for the following new electrical equipment or where indicated:
1. Service entrance rated 1,201 Amps and above.
- B. (SPDH) Provide high exposure SPDs for the following new electrical equipment or where indicated:
1. Service entrance rated 801 – 1,200 Amps.
 2. Switchboards located outside.
- C. (SPDM): Provide medium exposure SPDs at the following new electrical equipment or where indicated:
1. Service entrance rated 401 - 800 Amps.
 2. Panelboards above 600 Amps.
 3. Motor control centers.
 4. Non-service entrance switchboards.
- D. (SPDL): Provide low exposure SPDs at the following new electrical equipment or where indicated:
1. Service entrance rated 400 Amps and below.
 2. Panelboards 600 Amps and below.

3.3 TESTING

- A. Factory Trained Representative shall provide start-up to include initial verification of proper installation, shortest cable connection, and initiate factory warranty. The technician will be required to do the following as a minimum:
1. Verify the installation follows applicable national / local electrical codes related to SPDs and the manufacturer's Installation, Operation and Maintenance Instructions and recommendations.

2. Verify overcurrent device rating.
 3. Verify all wiring connections and installation conforms to manufacturer's recommendations.
 4. Record information for each product installed and include in O&M Manual
- B. A copy of the Factory diagnostic test report and written approval of the installation shall be included with the Electrical Operating and Maintenance Manual. The Contractor shall make all adjustments, changes, corrections, etc. as required by the Factory Trained Representative so that the installation follows the manufacturer's installation and operation instructions without additional charge to the Owner.

END OF SECTION

**SECTION 26 5113
LIGHTING FIXTURES**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Work Included: Lighting fixture work is as shown, scheduled and specified.
- B. Applications: The applications of lighting fixtures required for the project include the following:
 - 1. General lighting
 - 2. Emergency lighting
 - 3. Outdoor area lighting

1.2 QUALITY ASSURANCE

- A. Provide interior building LED fixtures that comply with the Design Lights Consortium (DLC) standards and are DLC or DLC Premium listed as a Qualifying Product at time of proposal submittal date.
- B. UL Standards: Lighting fixtures shall conform to applicable UL standards, and be UL or ETL labeled.
- C. Light fixtures shall conform to the requirements of NFPA 101, and 70 (NEC).

1.3 SUBMITTALS

- A. Submit product data for light fixtures, and emergency lighting equipment, including generator transfer devices.
- B. Specification Compliance Review: Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:.) Do not submit an outline form of compliance, submit a complete copy with the product data.
- C. Submittal data shall include luminaire efficiency parameters.
- D. Submittal data for exterior luminaires shall include IESNA BUG ratings, backlight, uplight, and glare ratings of each unique luminaire for the orientation and tile specified. Indicate total absolute lumens per luminaire and absolute lumens emitted above horizontal based by each luminaire for the orientation and tile specified.

1.4 WARRANTY

- A. Provide 5-year warranty on all light fixtures, including internal or remote LED drivers, all other electrical internal electrical or electronic components except for emergency battery packs or emergency load control device relays. Refer to other specific component warranty requirements below.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Provide products produced by manufacturers shown or scheduled for each type of lighting fixture. Refer to drawings for additional approved manufacturers.
 - 1. Light fixtures:
 - US LED
 - Extra Light
 - Acuity
 - Hubbell
 - Signify
 - Cooper Lighting Solutions
 - Pinnacle

- HE Williams
- GE Current
- LSI
- 2. LED Drivers:
 - Philips
 - Osram Optotronic
 - Eldo LED
- 3. Emergency Battery Packs with self-testing drivers/inverters:
 - Bodine
 - Chloride
 - Lithonia
 - Dual Lite
 - IOTA
- 4. Emergency Generator/Inverter Load Control Bypass Relay (ELC); UL924 listed and 0-10Vdc compatible:
 - Bodine
- 5. Emergency Generator / Inverter Branch Circuit Transfer Switch, UL 1008 listed and 0-10Vdc compatible:
 - Bodine GTD20A

2.2 MATERIALS AND COMPONENTS

- A. General: Provide lighting fixtures of the size, type, and rating indicated, with all accessories for a complete aesthetic installation.
- B. Fixture Types:
 - 1. General:
 - a. LED Lay-in edge lit or back flat panel / troffer fixtures: Opaque, edge or back lighted, 4000 Kelvin color temperature. 0-10 Vdc dimmable, L70: 60,000 minimum hours.
 - b. Safety chains and wire guards at fixtures in mechanical and electrical rooms, and high abuse areas. Provide safety chains only for gymnasium fixtures which shall be inherently vandal proof, no wire guards.
 - c. Fixtures located outdoors, in interior unconditioned spaces, and in wet locations shall be of aluminum construction.
 - d. Fixtures with door frames shall be of aluminum construction, white finish where located in kitchens, food prep areas, toilets, restrooms, locker rooms, dressing rooms, showers, and unconditioned spaces.
 - e. DLC, DLC Premium or Energy Star qualified unless specified otherwise.
 - f. Outdoor fixtures shall include a discrete / replaceable surge suppression device in addition to the surge suppression incorporated in the LED driver.
 - g. Operating temperature rating shall be between -40 degrees F and 120 degrees F.
 - i. Color Rendering Index (CRI): ≥ 80 Indoor; ≥ 65 Outdoor
 - j. The manufacturer shall have performed JEDEC (Joint Electron Devices Engineering Council) reliability tests on the LEDs as follows: High Temperature Operating Life (HTOL), Room Temperature Operating Life (RTOL), Low Temperature Operating Life (LTOL), Powered Temperature Cycle (PTMCL), Non-Operating Thermal Shock (TMSK), Mechanical Shock Variable Vibration Frequency, and Solder Heat Resistance (SHR).
 - 2. Downlight Fixtures: Provide recessed downlight fixtures with trim rings compatible with the ceiling material where fixture is to be installed.
 - 3. LED Exit Signs: Provide red lettering. The exit lighting fixtures shall meet the requirements of Federal, State, and Local Codes.
 - a. Gymnasiums, locker rooms, athletic/PE wing and associated corridors,

- black box theaters, auditorium stages, cafeteriums and kitchens: Vandal resistant, wet location cast aluminum with polycarbonate protective cover exit signs, Lithonia Extreme Series.
4. Emergency Lighting Units: Lead Calcium batteries with self-diagnostics. Provide full light output at 90 minutes of battery operation. LED lamps.
 5. Gymnasium light fixtures, glass or acrylic refractors or lenses, round profile, single point swivel pendant or hook mounting, designed to be vandal proof without the need for wire guards, no wire guards.
- C. LED drivers:
1. NEMA 410 compliant for in-rush current.
 2. Starting Temperature: -40° F [-40° C].
 3. Input Voltage: 120 to 480 (±10%) V.
 4. Power Supplies: Class I or II output.
 5. Surge Protection: The system must survive 250 repetitive strikes of “C Low” (C Low: 6kV/1.2 x 50 μs, 10kA/8 x 20 μs) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. “C Low” waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C.
 6. Power Factor (PF): ≥ 0.90.
 7. Total Harmonic Distortion (THD): ≤ 20%.
 8. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
 9. Drivers shall be reduction of hazardous substances (ROHS)-compliant.
- D. Voltage: Equipment for use on 120V systems shall be suitable and guaranteed for voltage range of 100V to 130V. Equipment on 277V systems shall be suitable and guaranteed for voltage range of 225V to 290V. Universal voltage equipment shall be suitable and guaranteed for a voltage range of 100V to 290V.
- E. Light fixture housing for exterior use: Provide aluminum or stainless housing. Where stainless steel hardware is used, both male and female fasteners shall be stainless steel.
- F. Emergency LED battery self-testing drivers and inverters; 5-year warranty. Basis of Design:
1. Bodine BSL-ST Series for OEM installation
 2. Bodine BSL310-SI Series for field installation
 3. Bodine ELI-S Series for line voltage sine wave inverter field installation
- G. Emergency Battery Packs – Exit Signs: Nickel Cadmium battery with self- diagnostics; Minimum 3-year non-prorated replacement warranty.
- H. Emergency Generator / Inverter Load Control Device (ELC):
1. 16 Amp minimum ballast / driver load
 2. Compatible with 0-10 Volt dimmer switches
 3. UL 924
 4. Minimum 3-year warranty
 5. Integral or remove test switch.
- I. Emergency Generator / Inverter branch circuit transfer switch:
1. UL 1008
 2. 20 Amp ballast/driver load
 3. 0-10Vdc dimming compatible

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install lighting fixtures of the types indicated, where shown, and at indicated heights in accordance with the fixture manufacturer's written instructions and industry practices to ensure that the fixtures meet the specifications. Fixtures shall fit the type of ceiling system scheduled.
- B. Standards: Comply with NEMA standards, applicable requirements of NEC pertaining to installation of interior lighting fixtures, and with NECA Standard of Installation.
- C. Attachment: Fasten fixtures to the indicated structural support members of the building.

- Provide four separate wire supports for recessed ceiling mounted lighting fixtures, one at each corner of fixture. Check to ensure that solid pendant fixtures are plumb. Provide T-bar locking clips on all four sides for lay-in fixtures.
- D. Coordination: Field coordinate and locate lighting fixtures in open ceiling areas including mechanical and electrical rooms so that light is not obstructed by piping, ductwork, etc. Locate light fixtures in front of electrical and mechanical equipment to provide adequate illumination for testing and maintenance. Relocate installed light fixtures as directed by Owner / Architect at no additional cost.
 - E. Final adjustment of all aimable exterior light fixtures shall be in coordination with, and to the satisfaction of, the Owner's designated representative. Pre-aim all fixtures prior to scheduled final aiming and adjustment with Architect / Owner. Verify that all rotatable optics are in their proper orientation prior to final aiming.
 - F. Provide vandal resistant exit signs without wire guards in all physical education and athletic sports areas, including egress corridors adjacent to these areas, black box theaters, auditorium stages, vocational shops, cafeteriums and kitchens.
 - G. Provide exit sign directional arrows as required. Provide a minimum of two and a maximum of 10% spare exit signs to be installed as directed by Architect.
 - H. Install in accordance with manufacturers instructions.
 - I. Install suspended luminaires using pendants supported from swivel hangers. Provide pendant length required to suspend luminary at indicated height.
 - J. Locate recessed ceiling luminaires as indicated on the Architectural reflected ceiling plan.
 - K. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prohibit movement.
 - L. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure. Provide auxiliary members spanning ceiling Ts to support surface mounted luminaires. Fasten surface mounted luminaires to ceiling T using bolts, screws, rivets, or suitable clips.
 - M. Install recessed luminaires to permit removal from below.
 - N. Install recessed luminaires using accessories and fire stopping materials to meet regulatory requirements for fire rating.
 - O. Install wall-mounted luminaires at height as directed by Architect.
 - P. Install accessories furnished with each luminary.
 - Q. Connect luminaires to branch circuit outlets using flexible conduit as specified.
 - R. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaires.
 - S. Bond products and metal accessories to branch circuit equipment grounding conductor.
 - T. Provide emergency transfer devices for light fixtures powered by generator or inverter emergency lighting circuits which are used for normal lighting and to be switched with the switched normal lighting circuit in the same room, corridor or area.
 - U. Provide un-switched, constant-hot circuit to all battery powered emergency lighting equipment and emergency load control devices (ELC). Where normal light fixture circuit is switched or contactor controlled, non-switched battery charging or ELC circuit shall originate from same branch circuit breaker as switched lighting circuit.
 - V. Provide emergency powered light fixture in front of all electrical switchgear, including but not limited to panelboards, switchboards, motor control centers, low voltage control panels, transfer switches, motor controllers and disconnect switches.
 - W. Provide emergency battery operated light fixtures at all transfer switch locations and at all central battery emergency lighting inverters.
 - X. Provide automatic controls for exterior light fixtures. Exterior building mounted light fixtures shall be circuited through lighting contactors. Lighting contactors shall be controlled by the Building Management System. Provide separate lighting contactors for:
 - 1. Parking Lot Lighting
 - 2. Building Mounted Lighting
 - 3. Exterior Signage

- Y. Lighting contactors shall not be installed above ceiling and shall be readily accessible, located in same room as panelboard serving load.
- Z. Wall mounted light fixtures shall be attached to the studs in the walls. Attachment to gypsum board only is not acceptable. Where wall mounted fixtures attach to junction box only, firmly secure junction box to adjoining studs in wall.
- AA. Lighting Fixture Supports:
 - 1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction to the structural slab or to structural members within a partition, or above a suspended ceiling.
 - 2. Shall maintain the fixture positions after cleaning and relamping.
 - 3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
- BB. Hardware for surface mounting fixtures to suspended ceilings:
 - 1. In addition to being secured to any required outlet box, fixtures shall be bolted to a grid ceiling system at four points spaced near the corners of each fixture. The bolts shall be not less than 1/4 inch secured to channel members attached to and spanning the tops of the ceiling structural grid members. Non-turning studs may be attached to the ceiling structural grid members or spanning channels by special clips designed for the purpose, provided they lock into place and require simple tools for removal.
 - 2. In addition to being secured to any required outlet box, fixtures shall be bolted to ceiling structural members at four points spaced near the corners of each fixture. Pre-positioned 1/4-inch studs or threaded plaster inserts secured to ceiling structural members shall be used to bolt the fixtures to the ceiling. In lieu of the above, 1/4-inch toggle bolts may be used on new or existing ceiling provided the plaster and lath can safely support the fixtures without sagging or cracking.
- CC. Lighting Fixture Supports for aluminum canopies:
 - 1. Light fixtures mounted under aluminum canopies shall be UL wet location from above listed without a protective ceiling or cover. Light fixture shall not have conduit penetrations or mounting hole penetrations field made in the top of the fixture. Conduit penetration shall be at the end of the fixture only.

3.2 TESTING

- A. General: Upon installation of lighting fixtures, and after building circuits are energized, apply electrical energy to demonstrate proper operations of lighting fixtures, emergency lighting, and controls. When possible, correct malfunctioning units at the site, then retest to demonstrate proper operation; otherwise, remove and replace with new units, and proceed with retesting.
- B. Pre-Inspection Tasks: Immediately before final inspection, clean fixtures inside and out, including plastics and glassware, adjust trim to fit adjacent surfaces, replace broken or damaged parts, and lamp and test fixtures for electrical and mechanical operations. Any fixtures, or parts of fixtures that show signs of rust or corrosion at the time of completion, shall be removed, and replaced with protected metal parts.
- C. Final aiming and Adjustment: Aim and adjust aimable and adjustable lighting fixtures for their intended purpose. Re-aim and re-adjust as required to the satisfaction of the Architect / Owner, including nighttime adjustment of exterior lighting in the presence of the Architect / Owner.

END OF SECTION

**SECTION 26 5561
THEATRICAL LIGHTING AND RIGGING SYSTEMS REFERENCE**

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Theatrical Lighting System.
- B. Theatrical Rigging System.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Construction Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.
- B. Theatrical lighting system TL series drawings and 11 61 00 specification.
- C. Theatrical rigging system TE series drawings and 11 61 33 specification.

1.3 RESPONSIBILITY AND RELATED WORK

- A. Coordinate scheduling of work with the Owner and Owner's Architect.
- B. Refer to TL0.00 and TE0.00 for division of responsibilities related to the theatrical lighting and rigging systems.

1.4 DEFINITION OF TERMS & ABBREVIATIONS:

- A. Provide: to supply and install.
- B. Furnish: to supply to another contractor for installation.
- C. Supply: to supply but not install.
- D. Install: to install but not supply.
- E. OFE: Owner furnished (supplied) equipment. Equipment will be provided to contractor for installation.
- F. NIC: Not In Contract. Refers to items that are not included in the scope of work outlined in this section but may be shown for coordination purposes or reference.
- G. Future: Equipment that will be provided by owner later. Accommodations shall be provided for future equipment as shown on the drawings.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE

END OF SECTION

SECTION 26 5667
SPORTS FIELD LIGHTING SYSTEM

PART 1 – GENERAL

1.1 SUMMARY

- A. Work covered by this section of the specifications shall conform to the contract documents, engineering plans as well as state and local codes.
- B. The purpose of these specifications is to define the lighting system performance and design standards for athletic fields using an LED Lighting source. The manufacturer / contractor shall supply lighting equipment to meet or exceed the standards set forth in these specifications. Basis of design manufacture: Musco.
- C. The sports lighting will be for the following venues:
 - 1. Tennis
- D. The primary goals of this sports lighting project are:
 - 1. Guaranteed Light Levels: Selection of appropriate light levels impact the safety of the players and the enjoyment of spectators. Therefore, light levels shall be guaranteed to not drop below specified target values for a period of 25 years from date of delivery of equipment to the site.
 - 2. Environmental Light Control: It is the primary goal of this project to minimize spill light to adjoining properties and glare to the players, spectators, and neighbors.
 - 3. Life-cycle Cost: In order to reduce the operating budget, the preferred lighting system shall be energy efficient and cost effective to operate. All maintenance costs shall be the responsibility of the manufacturer as indicated and included at no additional cost to the Owner for the duration of the warranty.
 - 4. Control and Monitoring: Provide a remote on/off control system for the lighting system. Fields shall be proactively monitored to detect luminaire outages over the 25-year life cycle. All communication and monitoring costs for 25-year period shall be included at no additional cost to the Owner.
- E. All lighting designs shall comply with local lighting ordinances.

1.2 SPECIFICATION COMPLIANCE REVIEW

- A. Provide a complete written, item-by-item specification review indicating compliance or deviation in full description.
- B. Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:.) Do not submit an outline form of compliance, submit a complete copy of the specification with the product data.

1.3 WARRANTY AND GUARANTEE

- A. 25-Year Warranty: Manufacturer shall provide a signed warranty covering the entire system for 25 years from the date of delivery to the site. The warranty shall guarantee specified light levels. The manufacturer shall maintain specifically funded financial reserves to assure fulfillment of the warranty for the full term. Warranty does not cover acts of God, weather conditions events such as lightning or hail damage, improper installation, vandalism or abuse, unauthorized repairs or alterations, or products made by other manufacturers.
- B. Maintenance: Manufacturer shall monitor the performance of the lighting system, including on/off status, hours of usage and luminaire outage for 25 years from the date of equipment shipment. Parts and labor shall be covered such that individual luminaire outages will be repaired when the usage of any field is materially impacted. Manufacturer shall provide all preventative and spot maintenance, including parts and labor for 25

years from the date of equipment shipment. Individual outages shall be repaired when the usage of any field is materially impacted. In event of an outage, Owner shall verify for the manufacturer that power is available to each lighting circuit controller, fuses, and lighting contactors.

PART 2 – PRODUCTS

2.1 ILLUMINATION PERFORMANCE REQUIREMENTS

- A. Illumination Levels and Design Factors: Playing surfaces shall be lit to an average target illumination level and uniformity as specified in the chart below. Lighting calculations shall be developed, and field measurements taken on the grid spacing with the minimum number of grid points specified below. Appropriate light loss factors including but not limited to dirt depreciation and optical material deterioration shall be applied and submitted for the basis of design. Average illumination level shall be measured in accordance with the IESNA LM-5-04 (IESNA Guide for Photometric Measurements of Area and Sports Lighting Installations). Illumination levels shall not drop below desired target values in accordance to IES RP-6-15, Page 2, Maintained Average Illuminance and shall be guaranteed for the full warranty period. Due to various dimensions of some athletic fields the actual quantity of grid points may vary, however the grid spacings shall be taken over the entire playing surface and the exact quantity adjusted accordingly.

Area of Lighting: Average annual usage	Average Target Illumination Levels	Maximum to Minimum Uniformity Ratio	Minimum Grid Points	Grid Spacing
Tennis	50 foot-candles	1.5:1.0	60/court	20' x 20'

- B. Color: The lighting system shall have a-color temperature of 4000K-5700K and a minimum CRI of 75.
- C. Mounting Heights: To ensure proper aiming angles for reduced glare and to provide better playability, minimum mounting heights shall be as described below. Provide mounting heights as required based on pole locations and setback from the field of play. Higher mounting heights may be required based on photometric report and ability to ensure the top of the field angle is a minimum of 10 degrees below horizontal.
- D. Aiming of any luminaire shall not be greater than 60 degrees from nadir.
- E. Center of luminaire cluster height at top of light poles: Typical average mounting height of a light cluster $H = [(1/3 W) + SB] \times \tan 30$. Width (W)= width of playing surface from foul line or inbound/outbound line to the opposite foul line or inbound/outbound line in the direction of the principal aiming of respective light standard pole. Pole Set Back (SB) = the distance from the nearest foul line or inbound/outbound line to the proposed light standard pole location.
- F. Unless indicated otherwise the center of an individual luminaire cluster's mounting height shall be as recommended by IES due to pole set back but in no case, shall any aiming angle of any luminaire aimed to the sports field exceed 60 degrees from nadir.

2.2 ENVIRONMENTAL LIGHT CONTROL

- A. Light Control Luminaires: All luminaires shall utilize spill light and glare control devices including, but not limited to, optical lensing, internal shields, louvers, or external shields.
- B. The first page of a photometric report for all luminaire types proposed showing horizontal and vertical axial candle power shall be provided to demonstrate the capability of achieving the specified performance. Reports shall be certified by a qualified independent testing laboratory with a minimum of five years' experience or by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory

Accreditation Program for Energy Efficient Lighting Products. A summary of the horizontal and vertical aiming angles for each luminaire shall be included with the photometric report.

2.3 SPORTS LIGHTING SYSTEM CONSTRUCTION

- A. Manufacturing Requirements: All components shall be designed and manufactured as a system. All luminaires, wire harnesses, drivers and other enclosures shall be factory assembled, aimed, wired and tested prior to shipment.
- B. Durability: All exposed components shall be constructed of corrosion resistant material and/or coated to help prevent corrosion. All exposed carbon steel shall be hot dip galvanized per ASTM A123. All exposed aluminum shall be powder coated with high performance polyester or anodized. All exterior reflective inserts shall be anodized, coated, and protected from direct environmental exposure to prevent reflective degradation or corrosion. All exposed hardware and fasteners shall be stainless steel of 18-8 grade or better, passivated and coated with aluminum-based thermosetting epoxy resin for protection against corrosion and stress corrosion cracking. Structural fasteners may be carbon steel and galvanized meeting ASTM A153 and ISO/EN 1461 (for hot dipped galvanizing), or ASTM B695 (for mechanical galvanizing). All wiring shall be enclosed within the cross-arms, pole, or electrical components enclosure.
- C. System Description: Lighting system shall consist of the following:
 - 1. Galvanized steel poles with maintenance platform/cage, climbing pegs, and cross-arm assembly.
 - 2. Non-approved pole technology:
 - a. Square static cast concrete poles will not be accepted.
 - b. Direct bury steel poles which utilize the extended portion of the steel shaft for their foundation will not be accepted due to potential for internal and external corrosive reaction to the soils and long-term performance concerns.
 - 3. Lighting systems shall use concrete foundations.
 - a. For a foundation using a pre-stressed concrete base embedded in concrete backfill, the concrete shall be air-entrained and have a minimum compressive design strength at 28 days of 3,000 PSI. 3,000 PSI concrete specified for early pole erection, actual required minimum allowable concrete strength is 1,000 PSI. All piers and concrete backfill must bear on and against firm undisturbed soil.
 - b. For anchor bolt foundations or foundations using a pre-stressed concrete base in a suspended pier or reinforced pier design pole, erection may occur after 7 days, or after a concrete sample from the same batch achieves a specified strength approved by the structural engineer.
 - 4. Manufacturer shall supply all LED drivers and supporting electrical equipment
 - a. Remote drivers and supporting electrical equipment shall be mounted approximately 10 feet above grade in aluminum NEMA 3RX enclosures. The enclosures shall be touch-safe and include drivers and fusing with indicator lights on fuses to notify when a fuse is to be replaced for each luminaire. Disconnect per circuit for each pole structure shall be located in the enclosure.
 - 5. Manufacturer shall provide surge protection at the pole equal to or greater than 40 kA for each line to ground (Common Mode) as recommended by IEEE C62.41.2_2002.
 - 6. Wire harness shall be complete with an abrasion protection sleeve, strain relief and plug-in connections for fast, trouble-free installation.
 - 7. All luminaires, visors, and cross-arm assemblies shall withstand 150 mph winds and maintain luminaire aiming alignment.
 - 8. Control cabinet shall provide remote on-off control and monitoring of the lighting

system.

9. Manufacturer shall provide lightning protection and grounding as defined by NFPA 780 and be UL Listed per UL 96 and UL 96A.
 - a. Integrated grounding via concrete encased electrode grounding system.
 - b. If grounding is not integrated into the structure, the manufacturer shall supply grounding electrodes, copper down conductors, and exothermic weld kits. Electrodes and conductors shall be sized as required by NFPA 780. The grounding electrode shall be minimum size of 5/8 inch diameter and 8 feet long, with a minimum of 10 feet embedment. Grounding electrode shall be connected to the structure by a grounding electrode conductor with a minimum size of 2 AWG for poles with 75 feet mounting height or less, and 2/0 AWG for poles with more than 75 feet mounting height.
- D. Safety: All system components shall be UL listed for the appropriate application.

2.4 ELECTRICAL

- A. Electric Power Requirements for the Sports Lighting Equipment:
 1. Maximum total voltage drop: Voltage drop to the disconnect switch located on the poles shall not exceed three (3) percent of the rated voltage.
- B. Equipment requiring electrical distribution more than that indicated or required by the basis of design shall be provided by the contractor at no additional cost to the Owner.

2.5 STRUCTURAL PARAMETERS

- A. Wind Loads: Wind loads shall be based on the latest published edition of the International Building Code and all local code requirements. Wind loads shall be calculated using ASCE 7-10, an ultimate design wind speed of 120 mph and exposure category C.
- B. Manufacturer Pole Structural Design: The stress analysis and safety factor of the poles shall conform to the latest published edition of AASHTO Standard Specification for Structural Supports for Highway Signs, Luminaires, and Traffic Signals (LTS-5).
- C. Manufacturer Foundation Design: The foundation design shall be based on soil parameters as outlined in the geotechnical report. If a geotechnical report is not utilized, the foundation design shall be based on class 5 soils.
- D. Manufacturer Foundation Drawings: Project specific foundation drawings stamped by a registered engineer in the state where the project is located are required. The foundation drawings must list the moment, shear (horizontal) force, and axial (vertical) force at ground level for each pole.

2.6 CONTROL

- A. Instant On/Off Capabilities: System shall provide for instant on/off of luminaires. Contactors shall be rated 60A/3P to utilize existing 40 Amp feeder circuits.
- B. Lighting contactor cabinet(s) constructed of minimum NEMA Type 3RX aluminum, designed for easy installation with contactors, labeled to match field diagrams and electrical design. Manual off-on-auto (momentary ON/OFF reverting to the AUTO position) rotary (non-keyed) selector switches shall be provided. The system shall be programmed for manual ON/OFF operation only.
- C. Remote Lighting Control System: System shall allow Owner and users with a security code to schedule on/off system operation via a web site, phone, fax, or email up to ten years in advance. Manufacturer shall provide and maintain a two-way TCP/IP communication link. Trained staff shall be available 24/7 to provide scheduling support and assist with reporting needs.
 1. The owner may assign various security levels to schedulers by function and/or

- fields. This function must be flexible to allow a range of privileges such as full scheduling capabilities for all fields to only having permission to execute “early off” commands. The scheduling tool shall be capable of setting curfew limits.
2. Controller shall accept and store 7-day schedules, be protected against memory loss during power outages, and shall reboot once power is regained and execute any commands that would have occurred during outage.
- D. Remote Monitoring System: System shall monitor lighting performance and notify manufacturer if individual luminaire outage is detected so that appropriate maintenance can be scheduled. The controller shall determine switch position (manual or auto) and contactor status (open or closed).
 - E. Management Tools: Manufacturer shall provide a web-based database and dashboard tool of actual field usage and provide reports by facility and user group. Dashboard shall also show current status of luminaire outages, control operation, and service. Mobile applications shall be provided suitable for IOS, and Android devices.
 - F. Hours of Usage: Manufacturer shall provide a means of tracking actual hours of usage for the field lighting system that is readily accessible to the owner.
 1. Cumulative hours: shall be tracked to show the total hours used by the facility
 2. Report hours saved by using early off and push buttons by users.
 - G. Communication Costs: Manufacturer shall include communication costs for operating the controls and monitoring system for a period of 25 years.

2.7 CONTROL OF EXISTING NON-MUSCO LIGHT POLES

- A. Provide three additional controlled 60A/3P lighting contactors for control of existing HID tennis court lighting. Include spare cabinet space as needed for future equipment/controls for monitoring of these three additional contactor circuits for future HID replacement to Musco LED.

PART 3 – EXECUTION

3.1 SOIL QUALITY CONTROL

- A. It shall be the Contractor’s responsibility to notify the Architect/Engineer/Owner immediately if unforeseen soil conditions exist other than those on which the foundation design is based or indicated in the project’s Geotechnical Report, or if the soil cannot be readily excavated.
 1. Provide engineered foundation embedment design by a registered engineer in the State where the project is located for soils other than specified soil conditions.
 2. Provide additional materials required to achieve alternate foundation design.
 3. Excavate and remove from the site materials other than normal soils, such as rock, caliche, etc.

3.2 FIELD QUALITY CONTROL

- A. Illumination Measurements: Upon substantial completion of the project and in the presence of the Contractor, Project Engineer, Owner’s Representative, and Manufacturer’s Representative, illumination measurements shall be taken and verified. The illumination measurements shall be conducted in accordance with IESNA LM-5-04.
- B. Field Light Level Accountability
 1. Light levels shall be guaranteed not to fall below the target maintained light levels for the entire warranty period of 25 Years.
 2. The contractor/manufacturer shall be responsible for an additional inspection one year from the date of substantial completion or commissioning of the lighting system and shall also utilize the Owner’s light meter in the presence of the Owner at the Owner’s request.
 3. The contractor/manufacturer shall make all changes needed to bring the fields back to compliance for light levels and uniformities. Contractor/Manufacturer shall be held responsible for any damage to the fields during these repairs and

- make repairs to the satisfaction of the Owner at no additional cost.
- C. Correcting Non-Conformance: If, in the opinion of the Owner or his appointed Representative, the actual performance levels including foot-candles and uniformity ratios are not in conformance with the requirements of the performance specifications and submitted information, the Contractor/Manufacturer shall make all adjustments required to meet specifications and satisfy the Owner at no additional cost to the Owner.

END OF SECTION

SUBMITTAL INFORMATION
Design Submittal Data Checklist and Certification

All items listed below are mandatory, shall comply with the specification and be submitted according to pre-bid submittal requirements

Include d	Tab	Item	Description
	A	Letter/ Checklist	Listing of all information being submitted must be included on the table of contents. List the name of the manufacturer's local representative and his/her phone number. Signed submittal checklist to be included.
	B	On Field Lighting Design	Lighting design drawing(s) showing: a. Field Name, date, file number, prepared by, and other pertinent data b. Outline of field(s) being lighted, as well as pole locations referenced to the center of the field (x & y), or home plate for baseball / softball fields. Illuminance levels at grid spacing specified c. Pole height, number of fixtures per pole, as well as luminaire information including wattage, lumens and optics d. Height of meter above field surface e. Summary table showing the number and spacing of grid points; average, minimum and maximum illuminance levels in foot candles (fc); uniformity including maximum to minimum ratio, coefficient of variance and uniformity gradient; number of luminaires, total kilowatts, average tilt factor; light loss factor. f. Alternate manufacturers shall provide both initial and maintained light scans using a maximum 0.70 Light Loss Factor to calculate maintained values.
	C	Off Field Lighting Design	Lighting design drawings showing spill light levels in footcandles as specified in section 1.3 A.
	D	Photometric Report	Provide photometric report for a typical luminaire used showing candela tabulations as defined by IESNA Publication LM-35-02. Photometric data shall be certified by laboratory with current National Voluntary Laboratory Accreditation Program or an independent testing facility with over 5 years experience.
	E	Life Cycle Cost calculation	Document life cycle cost calculations as defined in the specification. Identify energy costs for operating the luminaires, maintenance cost for the system including spot lamp replacement, and group relamping costs. All costs should be based on 25 Years.
	F	Luminaire Aiming Summary	Document showing each luminaire's aiming angle and the poles on which the luminaires are mounted. Each aiming point shall identify the type of luminaire.
	G	Structural Calculations	Pole structural calculations and foundation design showing foundation shape, depth backfill requirements, rebar and anchor bolts (if required). Pole base reaction forces shall be shown on the foundation drawing along with soil bearing pressures. Design must be stamped by a structural engineer in the state of Texas.
	H	Control and Monitoring	Manufacturer shall provide written definition and schematics for automated control system to include monitoring. They will also provide examples of system reporting and access for numbers for personal contact to operate the system.
	I	Electrical distribution plans	If bidding an alternate system, manufacturer must include a revised electrical distribution plan including changes to service entrance, panels and wire sizing, signed by a licensed Electrical Engineer in the state of Texas.
	J	Performanc e Guarantee	Provide performance guarantee including a written commitment to undertake all corrections required to meet the performance requirements noted in these specifications at no expense to the owner. Light levels must be guaranteed per specification for 25 years. Constant light systems shall provide independent 3 rd party test data stamped by a registered engineer.

	K	Warranty	Provide written warranty information including all terms and conditions.
	L	Project References	Manufacturer to provide a list of project references of similar products completed within the past three years.
	M	Product Information	Complete set of product brochures for all components, including a complete parts list and UL Listings.
	N	Non-Compliance	Manufacturer shall list all items that do not comply with the specifications.
	O	Compliance	Manufacturer shall sign off that all requirements of the specifications have been met at that the manufacturer will be responsible for any future costs incurred to bring their equipment into compliance for all items not meeting specifications and not listed in item N – Non-Compliance

Manufacturer:

Signature:

Contact Name:

Date: ____/____/____

**SECTION 26 5670
STRUCTURAL REQUIREMENTS FOR ATHLETIC LIGHTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Structural performance and design standards for sports lighting

1.02 RELATED REQUIREMENTS

- A. Division 26 - Exterior Athletic Lighting

1.03 REFERENCE STANDARDS

- A. AASHTO LTS-5 Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals
- B. ASCE 7-10 Minimum Design Loads for Buildings and Other Structures

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Provide engineered drawings stating compliance with this specification section
- C. The Professional Engineer performing the design of the athletic light pole foundations shall include a statement in their submittal regarding whether the mix design for light poles in Section 03 3000 is structurally acceptable to use for the athletic light pole foundations. If it is not structurally acceptable, the pole foundation engineer shall detail in their submittal what changes are necessary for the athletic light pole foundations, and the Contractor shall make those changes to the mix when placing athletic light pole foundation concrete.

1.05 QUALITY ASSURANCE

- A. Work covered by this section of the specifications shall conform to the contract documents, as well as state and local codes.
- B. The purpose of these specifications is to define the structural performance and design standards for sports lighting. The manufacturer/contractor shall supply lighting equipment to meet or exceed the standards set forth by the criteria set forth in these specifications

1.06 STRUCTURAL PARAMETERS

- A. A Professional Engineer licensed in the State of Texas and hired by the Contractor shall design all exterior athletic lighting structures and submit sealed calculations (as a separate submittal from the electrical submittal) to Huckabee Engineering for Structural Engineering review before fabrication. Poles and other support structures, brackets, arms, bases, anchorages and foundations shall be designed to resist wind loads as determined by ASCE 7-10 based on a Basic Wind Speed (3 second gust) as shown for the project location in the Mapped Basic Wind Speeds for Risk Category III with Exposure Category C. Luminaires, visors and crossarms shall be designed to resist wind loads based on a Basic Wind Speed of 150 mph (3 second Gust) or the ASCE 7-10 mapped Basic Wind Speed (3 second gust), whichever is higher, while maintaining luminaire aiming alignment. All designs shall comply with the 2012 International Building Code (IBC). The effects of fatigue shall be considered during design at the equivalent static wind pressure as determined by AASHTO LTS-5 "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals" with the fatigue importance factor associated with Fatigue Category I and the maximum permitted stresses for the fatigue analysis shall be based on an infinite number of cycles as determined by ANSI/AISC 360-10, including Appendix 3.
- B. If the project location is near the line between different mapped Basic Wind Speeds, proposers shall assume for proposal purposes that the higher wind speed shall be required unless the Buiding Official indicates otherwise.

- C. The athletic light pole designs shall comply with the requirements in this specification section, even if other specification sections have different structural requirements for light poles, so that all requirements are met.
- D. If the locally adopted building code cited in Specification Section 01 4100 "Regulatory Requirements" is different than the 2012 IBC, then the athletic light pole designs shall also comply with the locally adopted building code in addition to complying with the requirements in this specification section, which are based on the 2012 IBC.
- E. Corrosion Resistance Requirements: To reduce the potential for corrosion, which could lead to structural failure of the poles during the intended design life, all steel shall be galvanized. All welding shall occur before galvanization. It shall not be permitted to weld or cut any galvanized members after galvanizing. Painting a galvanizing repair product over welds or field cuts shall not be permitted. If post-galvanized welding or cutting of members occurs, members shall be replaced at no cost to the Owner. If base plates are part of the design, it shall not be permitted for the top of the pier to be below grade and it shall not be permitted to grout under any base plates. If grout is installed under base plates, at no cost to the Owner the light poles shall be disconnected and lifted from the foundation so that the grout can be completely removed and the pole replaced and reconnected. The Contractor shall be responsible for monitoring for these conditions and shall be responsible for remediation at no cost to the Owner even if such conditions are noted by the Architect or Engineer during the Final Punchlist.
- F. Soil Conditions: The design criteria for these specifications are based on soil design parameters as outlined in the geotechnical report. If a geotechnical report is not provided by the owner, the foundation design shall be based on soils that meet or exceed those of a Class 5 material as defined by 2012 IBC.
 - 1. It shall be the Contractor's responsibility to notify the owner if soil conditions exist other than those on which the foundation design is based, or if the soil cannot be readily excavated. Contractor may issue a change order request / estimate for the owner's approval / payment for additional costs associated with:
 - 2. Providing engineered foundation embedment design by a registered engineer in the State of Texas
 - 3. Additional materials required to achieve alternate foundation.
 - 4. Excavation and removal of materials other than normal soils, such as rock, caliche, etc.
- G. Foundation Drawings: Project specific foundation drawings stamped by a registered engineer in the state where the project is located are required. The foundation drawings must list the moment, shear (horizontal) force, and axial (vertical) force at ground level for each pole.

1.07 FIELD CONDITIONS

- A. Existing Conditions: See Section 00 3132 - Geotechnical Data

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

**SECTION 27 0100
OPERATION AND MAINTENANCE (O&M) MANUALS
OF COMMUNICATIONS SYSTEMS**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Compile product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified in this Section and as referenced in other sections of specifications.
- B. Instruct Owner's personnel in operation and maintenance of equipment and systems.
- C. Submit three (3) electronic copies, on separate devices (USB Flash Drive or some type of pre-approved solid-state storage device), of complete O&M manuals in final form. The submitted manual shall be the system manufacturer's operations manual, supplemented with operations and maintenance instructions custom tailored for the system installed. Electronic documentation shall be provided in a non-proprietary PDF format, without password restrictions.
- D. Hard copies shall be provided upon request of the Owner, Architect, and/or Consultant.
- E. Recorded video of all training sessions shall be included in each copy, of each system's final submitted O&M.
- F. The final submitted manual shall include a sign-in sheet and owner/consultant signed acceptance of all training sessions.

1.2 ELECTRICAL OPERATING AND MAINTENANCE MANUAL SUBMITTAL SCHEDULE

- A. Thirty (30) days after receipt of reviewed submittals bearing the Project Technology Consultant's stamp of acceptance (including re-submittals), submit for review, an electronic copy of the first draft of the System's O&M Manual. This copy shall contain as applicable to the specific system, a minimum of the following:
 - 1. Table of Contents for each element
 - 2. Contractor information
 - 3. All shop drawings, coordination drawings and product data, bearing the Project technology Consultant's stamp of acceptance.
 - 4. All parts and maintenance manuals for items of equipment
 - 5. Warranties (without starting dates)
 - 6. Certifications that have been completed; submit forms and outlines of certifications that have not been completed
 - 7. Operating and maintenance procedures.
 - 8. Form of Owner's Training Program Syllabus (including times and dates)
 - 9. Control operations / equipment wiring diagrams
 - 10. Coordination Drawings
 - 11. Schedule of Speakers, Amplifiers, Sound Equipment, Etc.
 - 12. Schedule of Handsets and other Peripheral Devices, Etc.
 - 13. Schedule of Cable, Jacks, Outlets, Etc.
 - 14. Access Control Door Schedules
 - 15. Video Surveillance Camera Schedules
 - 16. Other required operating and maintenance information that are complete.
 - 17. Cable pathway layout drawings and station map, including through wall and floor penetration locations and sleeve sizes.
- B. Copy will be returned to the Contractor within 15 days with comments for corrections.
- C. Submit the electronic completed manuals (hard copies upon request) in final form to the Project's Technology Consultant.
 - 1. Prior to substantial completion for Owner's use after the Owner accepts facility maintenance.
 - 2. Include all specified data, test reports, drawings, dated warranties, certificates, training videos. along with other materials and information.
- D. The Project's Technology Consultant shall review the manuals for completeness within

- 15 days.
- E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Project's Technology Consultant. The manuals will not be retransmitted.
 - F. Electronic and/or hard copies of the accepted manuals shall be delivered to the Owner prior to substantial completion.

PART 2 - PRODUCTS

2.1 BINDERS

- A. Upon the request for hard copies of the O&M manuals, the binders shall consist of the following configuration:
 - 1. Commercial quality black, 3-ring binders with clear, durable, cleanable plastic covers.
 - 2. Minimum ring size: 1"; Maximum ring size: 3".
 - 3. When multiple binders are used, correlate the data into related groupings.
 - 4. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 SYSTEM OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals Submitted in Hard Copy Format:
 - 1. Prepare data in form of an instructional manual for use by Owner's personnel.
 - 2. Format:
 - a. Size: 8-1/2" x 11"
 - b. Text: Manufacturer's printed data or neatly typewritten.
 - 3. Drawings:
 - a. Provide reinforced punched binder tab and bind in text.
 - b. Fold larger drawings to size of text pages.
 - 4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
 - 5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
 - a. Title of Project
 - b. Identity of separate structures as applicable
 - c. Identity of general subject matter covered in the manual.
 - 6. Binder as specified
- B. Content of Manual:
 - 1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
 - a. Contractor, name of responsible principal, address and telephone number
 - b. A list of each product required to be included, indexed to content of the volume.
 - c. List with each product, name, address and telephone number of:
 - 1) Subcontractor or installer
 - 2) Maintenance contractor as appropriate
 - 3) Identify area of responsibility of each.
 - 4) Local source of supply for parts and replacement
 - d. Identify each product-by-product name and other identifying symbols as set forth in Contract Documents.
 - 2. Product Data:
 - a. Include those sheets pertinent to the specific product.
 - b. Annotate each sheet to:
 - 1) Identify specific product or part installed.
 - 2) Identify data applicable to installation.

- 3) Delete references to inapplicable information.
 3. Drawings:
 - a. Supplement product data with drawings as necessary to illustrate:
 - 1) Relations of component parts of equipment and systems
 - 2) Control and flow diagrams
 - b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
 - c. Do not use Project Record Documents as maintenance drawings.
 4. Written text as required to supplement product data for the particular installation:
 - a. Organize in consistent format under separate headings for different procedures.
 - b. Provide logical sequence of instructions for each procedure.
 5. Copy of each warranty, bond and service contract issued
 - a. Provide information sheet for Owner's personnel, giving:
 - 1) Proper procedures in event of failure
 - 2) Instances that might affect validity of warranties or bonds
 6. Shop drawings, coordination drawings and product data as specified.
- C. Sections for Equipment and Systems
1. Content for each unit of equipment and system as appropriate:
 - a. Description of unit and component parts:
 - 1) Function, normal operating characteristics, and limiting conditions.
 - 2) Performance curves, engineering data and tests.
 - 3) Complete nomenclature and commercial number of replaceable parts.
 - b. Operating procedures:
 - 1) Start up, break-in, routine / normal operating instructions
 - 2) Regulation, control, stopping, shut down and emergency instructions
 - 3) Special operating instructions
 - c. Maintenance procedures:
 - 1) Routine operations
 - 2) Guide to trouble-shooting
 - 3) Disassembly, repair and reassembly
 - 4) Alignment, adjusting and checking
 - 5) Routine service based on operating hours
 - d. Manufacturer's printed operating and maintenance instructions.
 - e. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
 - f. Complete equipment field accessible wiring diagrams
 - g. Each Contractor's coordination drawings
 - h. Other data as required under pertinent sections of the specifications
 2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
 3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications
 4. Provide complete information for products specified in Division 27.
 5. Provide certificates of compliance as specified in each related section.
 6. Provide start up reports as specified in each related section.
 7. Provide signed receipts for spare parts and material.
 8. Provide training report and certificates.

END OF SECTION

SECTION 27 0500
COMMUNICATIONS BASIC MATERIALS, METHODS, AND GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of Division 01 General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 27 Communications.
- B. Applicable provisions of this section apply to all sections of Division 27, Communications.
- C. The general provisions of the Contract and the requirements of the following Sections apply to the Work specified in this Section. See following sections for related general and specific requirements following sections shall associate with this specification as applicable.
 - 1. Division 26 in its entirety.
 - 2. Division 27 in its entirety.
 - 3. Division 28 in its entirety.
- D. The entire drawing and specification package apply to the work specified in the communication specifications and shall be complied with in every respect. The Contract Documents are comprised of the drawings and specifications. The Contractor shall examine these Contract Documents, and coordinate required work indicated in each.

1.2 CODES AND STANDARDS

- A. All equipment and work performed shall comply with current and applicable Codes, Standards, Rules, Ordinances, Regulations, and Best Practices (both published and best practices) as well as any other authorities that may have lawful jurisdiction pertaining to the work specified. None of the terms or provisions of this specification shall be construed as waiving any of the rules, regulations, or requirements of these authorities (including those not specifically listed in this Specification). Applicable Codes and Standards shall consist of, but not be limited to the following:
 - 1. Americans with Disabilities Act (ADA)
 - 2. Authorities Having Jurisdiction (AHJ) - Local
 - 3. American National Standards Institute (ANSI)
 - 4. American Society of Testing and Materials (ASTM) *Communications Cables - B694, B736, D4565, D4566, D4730, D4731, D4732*
 - 5. Building Industry Consulting Services International (BICSI)
 - 6. Code of Federal Regulations - Title 47
 - 7. Electronics Industries Association (EIA) *Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices - EIA-455 Series*
 - 8. Federal Communications Commission (FCC) - Communications Act and FCC Rules
 - 9. Federal Information Processing Standards (FIPS) *Federal Building Standard for Telecommunications Pathways and Spaces - FIPS PUB 175, FIPS PUB 176*
 - 10. The Insulated Cable Engineers Association (ICEA) *Communications Cable Stands - P-47-434, S-56-434, S-80-576, S84-608, S-85-625, S-86-634, S-87-640, S-89-648, S-90-661, S-98-688, S-99-689, S-100-685*
 - 11. International Electro-technical Commission (IEC)
 - 12. Institute of Electrical and Electronic Engineers (IEEE) *Local Area Networks/Metropolitan Networks Standards Collection - LAN/MAN 802 Series*
 - 13. International Organization for Standardization (ISO) (ISO/IEC) *Premise Wiring Core and LAN/MAN Core Equivalents-11801, 8802, 14763-1*
 - 14. International Telecommunication Union (ITU-T) *Telecommunications Standardization*

15. National Electrical Code (NEC) *National Electrical Code - NFPA 70*
 16. National Electrical Contractor's Association (NECA) *Standards of Installation*
 17. National Electrical Manufacturers Association (NEMA) *Performance Standard for Twisted Pair Premise Voice and Data Communications Cable-WC 63.1, WC 63.2, WC 66*
 18. National Electrical Safety Code (NESC)
 19. National Fire Protection Association (NFPA) - *National Fire Alarm Code NFPA 72, Life Safety Code NFPA 101*
 20. Society of Cable Telecommunications Engineers (SCTE)
 21. Local Accessibility Standards
 22. Telecommunications Industries Association (TIA) (*ANSI/TIA/EIA Wiring and Cabling Standards - 526, 568, 569, 570, 571, 598, 606, 607, 758, TSB 31-B, 63, 67, 72, 75 and 95*)
 23. Uniform Building Code (UBC)
 24. Underwriters Laboratories, Inc. (U.L.) - *497A, 910, 1077, 1863, 1283, 1459, 1604, 1651, 1681, 1690, 1778, 1977*
- B. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.
- C. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.
- D. Obtain all permits required.

1.3 SUMMARY

- A. The work covered by the specifications includes furnishing materials, labor, transportation, tools, permits, fees, utilities, and incidentals necessary for the complete installation of work required in the Contract Drawings.
- B. It is the intent of the Contract Documents to provide a new and/or an extension of the existing installation, as shown in the associated specifications and drawings, complete in every respect.
- C. Provide complete and working Communications Systems including equipment, conduit, wiring, material, labor and training as described in this Specification and the Drawings. The Communications Systems Drawings and Specifications are the sole property of the Architect and are not to be duplicated, scanned, loaned or in any way made available to persons not designated as authorized by the Architect. All Communications Systems plans, and specifications are to be returned to the Architect following completion of bid.

1.4 CONTRACTOR'S QUALIFICATIONS

- A. An approved contractor for the work under this division shall be:
1. A specialist in this field and have the personnel, experience, training, and skill, and the organization to provide a practical working system.
 2. Able to furnish evidence of having contracted for and installed not less than ten (10) systems of comparable size and type that have served their Owners satisfactorily for not less than 3 years.
 3. Perform work by persons qualified to produce workmanship of specified quality. Persons performing work shall be required to be licensed. Onsite supervision shall have minimum of the following:
 - a. Licenses, as applicable to the system being installed
 - b. Manufacturer's Certifications
 - 1) Firm Certification
 - 2) Installer Certification
 - 3) Programmer's Certification
 - 4) System Designer Certification.

1.5 DRAWINGS AND SPECIFICATIONS

- A. The drawings and these specifications are complementary to each other, and what is required by one shall be as binding as if required by both.
- B. If variations or departures from the drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted to the Consultant for review. No departures shall be made without prior written acceptance of the Consultant.
- C. Should the drawings or specifications disagree in themselves or with their counterpart, the better quality or greater quantity of work or materials shall be estimated upon, and unless otherwise directed by the Consultant in writing, shall be performed or furnished. In the case that the specifications should not fully agree with the Schedules, the latter shall govern. Figures indicated on drawings govern scale measurements and large-scale details govern small scale drawings.
- D. The approximate locations of system equipment and components are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of equipment, field devices, etc. Exact locations are to be determined by actual measurements at the building and will in all cases be subject to the Review of the Owner or Consultant, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.
- E. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.
- F. Any discrepancies between the Contract Documents and actual job site conditions shall be reported to the Owner or Consultant, so that they will be resolved prior to the bidding, where this cannot be done at least 7 working days prior to bid; the greater or costlier of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.
- G. It is the intention of this Section of the Specifications, and associated drawings, to outline minimum requirements to furnish the Owner with a turnkey and fully operating system in cooperation with other trades.
- H. The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the shop drawings accepted by project's consultant.
- I. The Contractor shall be responsible for coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself with the existing site conditions, details of the work and the working conditions, and verify dimensions in the field. The Contractor shall advise the project's consultant of any discrepancy prior to bidding. The submission of bids shall be deemed evidence of the Contractor's site visit; coordination of existing conditions and include consideration for existing conditions.
- J. These documents are conceptual in nature. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer's shop drawings and product data submittals shall represent a complete system and documents accepted by the project's consultant shall not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project's Technology Consultant and the Owner.

1.6 BUILDING CONSTRUCTION AND LAYOUT OF WORK

- A. General: It shall be the responsibility of the Contractor to consult the Engineering
-

- Drawings and Details so as to thoroughly familiarize himself with the type and quality of construction to be provided on this project.
- B. The drawings are diagrammatic in nature and do not show every connection in detail or every line or conduit in its exact location. These details are subject to the requirements of all codes, ordinances, and standards; as well as all structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in closed ceiling space and/or furred chases unless specifically noted or indicated to be exposed. Work shall be installed to avoid crippling of structural members. All work shall be run parallel or perpendicular to the lines of the building unless otherwise noted.
 - C. The approximate location of equipment items is indicated on the drawings. Exact locations are to be determined by coordination of dimensions from approved equipment submittals and site-verified field measurements and will in all cases be subject to the approval of the Consultant. The Consultant reserves the right to make any reasonable changes in the indicated locations prior to installation for no additional cost.
 - D. In areas of existing special ceiling construction, the removal and restoration must be carefully planned such that the existing condition of the ceilings is maintained. It may be necessary for the Contractor to procure a Subcontractor familiar with this work to achieve this requirement.
 - E. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.7 RELATION WITH OTHER TRADES

- A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements. Extend electrical services and final connections to all items requiring same.
- B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.
- C. Where cabling pass through walls or floors, metal sleeves shall be provided and shall be sealed to prevent spread of fire and smoke. In walls, they shall extend 3" beyond the finished surface. In pipe chases, they shall extend 8" inches above floor slab and be cemented in a watertight manner. Size of these sleeves shall be at least as required to maintain a maximum 40% conduit fill ratio. 1/2 inch greater than outside diameter of the conduit.
- D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.
- E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under other Division. Determine from the General Contractor / Construction Manager for the various trades, the Owner, and by direction from the Architect / Engineer, the exact location of all items. The construction trades involved shall furnish all roughing-in drawings and wiring diagrams required for proper installation of the electrical work.
 - 1. Make final connections to all communications equipment indicated on the drawings, except as noted.
- F. Request all Shop Drawings required in ample time to permit proper installation of all electrical provisions.
- G. Extend services as indicated to the various items of equipment furnished by others. Rough-in for the various items and make final connections ready for operation upon placing of the equipment.

1.8 CONCEALED AND EXPOSED WORK

- A. When the word "concealed" is defined as hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is defined as open to view, in plain sight.

1.9 GUARANTEE

- A. Guarantee work for a minimum of two years or as noted longer elsewhere from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.10 MATERIAL AND EQUIPMENT

- A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.11 NOISE AND VIBRATION

- A. Select equipment to operate with minimum noise and vibration. If noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, and judged objectionable by the Owner, Architect, or Engineer, rectify such conditions at no additional cost to the Owner. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.12 ACCEPTABLE MANUFACTURERS

- A. Manufacturers names and catalog number specified under sections of Division 27 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer shall be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before proposal due date. Submit complete design and performance data to the Architect. The Architect and Owner issue approvals of acceptable manufacturers as addenda to the Construction Proposal Documents.
- B. Where acceptable manufacturers are listed, only products of those manufacturers may be provided. Additionally, the product must meet all the detailed requirements of the specifications.
- C. If no manufacturer's name is mentioned, the Contractor shall provide equipment and material which meet the specifications.

1.13 UTILITIES, LOCATIONS AND ELEVATIONS

- A. Locations and elevations of the various utilities included within the scope of this work:
 - 1. Obtained from utility maps and other substantially reliable sources.
 - 2. Are offered separate from the Contract Documents as a general guide only without guarantees to accuracy.
- B. Examine the site and verify the location and elevation of all utilities and of their relation to the work. Existing utilities indicated on the site plans are for reference only and shall be field verified by the Contractor with the respective public or private utility.

1.14 CONTRACT DRAWINGS

- A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

- B. It is the responsibility of the Contractor to compare the scale of all electrical drawings with the scale of the architectural drawings and make adjustments to all electrical drawings which have the incorrect drawing scale so that his material takeoffs are not in error due to an incorrectly labeled drawing scale and his proposal is complete.

1.15 ABBREVIATIONS AND DEFINITIONS

A/V	Audio/Visual
AWG	American Wire Gauge
BCR	Building Communications Room
CATV	Cable Antenna Television
CCTV	Closed Circuit Television
CMP	Communications Media Plenum
CMR	Communications Media Riser
dB	Decibel
EMI	Electromagnetic Interference
ER	Equipment Room
FACP	Fire Alarm Control Panel
FCR	Floor Communications Room
Gbps	Giga Bits Per Second
Hz	Hertz
IC	Intermediate Cross-connect
IDF	Intermediate Distribution Frame
IM	Information Management
IS	Information Systems or Information Services (also see MIS)
IT	Information Technology
Km	Kilometer
LCD	Liquid Crystal Display
LED	Light Emitting Diode
M	Micron
MATV	Master Antenna Television (<i>A.K.A. Main Antenna Television</i>)
Mbps	Mega Bits Per Second
MC	Main Cross-connect
MDF	Main Distribution Frame
MHz	Megahertz
MIS	Management Information Systems or Services
NEXT	Near-End Cross Talk
nm	Nanometer
OFN	Optical Fiber Non-conductive
OFNP	Optical Fiber Non-conductive Plenum
OFNR	Optical Fiber Non-conductive Riser
OTDR	Optical Time Domain Reflectometer
PBX	Private Branch Exchange
POS	Point of Sale
PSELFEXT	Power Sum Equal Level Far-End Cross Talk
PSNEXT	Power Sum Near-End Cross Talk
SMATV	Satellite Main Antenna Television
TC	Telecommunications Closet (<i>Now referred to as TR</i>)
T.O.	Telecommunications Outlet
TR	Telecommunications Room (<i>A.K.A. TC - Telecommunication Closet</i>)
UTP	Unshielded Twisted Pair Wire

Definitions:

Administration Subsystem - Cable, connectors, cross-connect and inter-connect hardware, patch cords, and other equipment that allows easy reconfiguration of the telecommunications system to accommodate personnel and floor plans changes.

Campus Backbone Subsystem - Connects telecommunications processing equipment in different buildings on the same campus.

Communications Cabling - Any fiber optic, copper, coaxial or other transmission media used for transmitting or receiving communications systems data.

Communications System - Communications Systems and associated wired or wireless interconnection.

Communications Drawings - All floor plans, elevations, details, schematics, block diagrams, legends, tables, notes or attachments associated with any or all of the Communications Systems.

Distribution Cable - The telecommunications UTP wiring between the telecommunications room and the outlet connectors.

Equipment Subsystem - Telecommunications cable, connectors, support hardware, blocks, and protective devices that serve to connect the network interface and the backbone subsystem through the administrative subsystem.

Horizontal Subsystem - Telecommunications cable, outlets and distribution cords that extend the riser backbone from the administrative points in the TRs to workstations.

Information Systems - Software systems including operating systems, programs, data manipulation and management systems, control software and various forms of proprietary and off-the-shelf software.

Information Technology - The practical application of knowledge associated with designing, installing and maintaining the equipment, hardware and infrastructure utilized for control, distribution, or display of telecommunications, audio, video and data signals. Because computers are central to information management, computer departments within companies and universities are often called (IT Departments) and are responsible for MIS or IS personnel and services.

Low Voltage Wire - Wire or cable used for one or more systems that operate on 24 volts or less. Low Voltage Wire is used to install and interconnect one or more of the Communications Systems. Low Voltage Wire includes patch cords, jumpers and all portions of cable or wire used to make the Communications Systems operational or for system communications.

Management Information Systems - A class of software that provides managers with tools for organizing and evaluating their department. Typically, MIS systems are written in COBOL and run on mainframes or minicomputers. Within companies and large organizations, the department responsible for computer systems is sometime called the MIS department. Another name for MIS is Information Services (IS).

Multiplexer - A communications device that multiplexes (combines) several signals for

transmission over a single medium. A multiplexer is sometimes called a "mux". A demultiplexer is required to complete the process by separating multiplexed signals from a transmission line. Frequently a multiplexer and demultiplexer are combined into a single device capable of processing both outgoing and incoming signals.

Riser Backbone Subsystem - Telecommunications cable, splice enclosures, and associated hardware that provide the main cable routes in a building. It interconnects building floors and larger areas of a single floor. It also interconnects administrative points in satellite TRs to the administrative points in the building main equipment room.

Station Cable - The wiring between the outlet connections and the work area equipment.

Communications Systems - One or more of the following and associated equipment: Data/Networking Systems, Telecommunications Systems, Paging / Intercom Systems, Clock/Control Systems, Master Antenna Television Systems, Cable Antenna Television Systems, Broadcast Video Systems, Audio/Visual Presentations Systems, Microwave/Wireless Systems.

Telecommunications - The transmission, emission or reception of signs, signals, images, sound or intelligence of any nature by wire, radio, optical or other technical transmission system.

Work Area - Location of an employee or student and their data/telecommunications equipment or devices.

Work Area Subsystem - Station mounting cords, extension cords, connectors, adapters, and interface units that provide physical and electrical connectivity between workstation equipment and the horizontal subsystem.

1.16 QUALITY ASSURANCE

- A. Equipment Standards:
 - 1. System and all components shall be brand new stock from manufacturer.
 - 2. All electronics shall be 100% solid state.
 - 3. System and all components shall bear a UL Label.
- B. Contractor Qualifications:

At the time of Proposal, the Contractor shall:

 - 1. Have manufactured, supplied or installed at least three (3) other systems of similar size, complexity, and general operation as the systems described in these specifications. The Contractor shall furnish in writing to Architect proof of compliance with this paragraph at the time of proposal.
 - 2. Hold all legally required Texas State Contractor's licenses necessary to accomplish the installation and activation of the described system at the facilities indicated. The Contractor shall submit copies of licenses to the Architect prior to the start of work
 - 3. Hold all legally required state registrations to meet local requirements for submittal drawings.
 - 4. Have a local office within fifty (50) miles of the project site staffed with factory trained technicians who have experience on systems of similar complexity and function as the systems described in these specifications. These technicians shall be fully capable of system engineering support, installation supervising, system start-up, and providing the Owner with training and service on both hardware and software for the systems specified.
 - 5. Certify complete and total compliance with the provisions of these specifications

by letter or submittal of the proposal response forms, signed by an officer of the corporation, or a principal if other ownership currently exists. In addition, the letter or forms shall include a complete listing of exceptions, if any.

1.17 SUBMITTALS

- A. Provide SUBMITTALS according to Division 01 and the following.
- B. Requirements:
 - 1. Submit paragraph-by-paragraph specification review indicating compliance or deviation with explanation.
 - 2. Submit proof that all system components and cables are U.L. Listed.
 - 3. An equipment list with names of manufacturers, model numbers, and technical information on all equipment proposed. Clearly mark exact model number proposed to be installed.
 - 4. Product technical information sheets for each principal component in the proposed system, including cable, wire, terminal marking, and wire marking material.
 - 5. Certification from the manufacturer stating that the system Contractor is an authorized distributor or installer of the proposed system when such certifications exist.
 - 6. A statement listing every technical and operational parameter wherein the submitted equipment varies from that which was originally specified. If the submitter fails to list a particular variance and his submittal is accepted but is subsequently deemed to be unsatisfactory because of the unlisted variance, the submitter shall replace or modify such equipment at once and without cost to the Owner.

1.18 EXAMINATION OF SITE

- A. The Contractor shall have visited the site and familiarized himself with all existing conditions prior to submitting his proposal and shall be prepared to carry out the work within the existing limitations. Failure or neglect to do so shall not relieve the Contractor of his responsibilities not entitle him to additional compensation for work overlooked and not included in his proposal.
- B. The Contractor shall confirm the availability of the proper power source for each piece of specified equipment, through site visits and Drawings as necessary. Where proper power does not exist, the Contractor shall provide the required power, circuits, outlets, conduits, and wire as specified under Division 26.

1.19 DATA ACCURACY

- A. Absolute accuracy of information regarding existing conditions cannot be guaranteed. The Drawings and Specifications are for the assistance and guidance of the Contractor and exact locations, distances, elevations, etc., shall be governed by actual field conditions. Where variations from the contract documents are required, such variations shall be approved by the Architect / Owner.

1.20 SECURITY

- A. The Contractor is responsible for complying with all of the Owner's and facility security's requirements to prevent theft or damage to equipment, tools and materials. If any deviation from facility security requirements is necessary, approval for such deviation shall be coordinated with the Owner.
- B. The Contractor shall not disclose any confidential information of the Owner. The Contractor acknowledges that such action is highly injurious and can do damage to the Owner. The Contractor will agree to and comply with the standard policies and provisions of the Owner regarding outside Contractors and Consultants.

1.21 UTILITIES

- A. It shall be the responsibility of the Contractor to provide all temporary connection and cables, lighting, light stands and power. The facilities shall be used in accordance with all applicable regulations regarding operations, safety and fire hazards of the governmental Authorities Having Jurisdiction, provided they are not used in a wasteful manner.

1.22 PERMITS

- A. All permits required for the specified performance and completion of the work shall be secured by the Contractor. These permits shall be presented and reviewed at the initial project progress meeting.

1.23 NOTIFICATION

- A. The Contractor shall not shut off any existing systems. The Contractor shall give the Owner at least ten (10) calendar day's notice of any requirements to shut off or interference with existing alarm, regulating, computer or other service systems. The Owner will arrange and execute any shutdown. All work such as splicing, connections, etc., necessary to establish or re-establish any system shall be completed by the Contractor in close coordination with the Owner.

1.24 INTERFERENCES WITH THE OWNER

- A. Transportation and storage of materials at the facility, work involving the facility, and all other matters affecting the habitual use by the Owner of its buildings, shall be conducted so as to cause the least possible interference, and at times and in a manner acceptable to the Owner. The Contractor shall make every effort to delivery equipment per the schedule required by the project.

1.25 PROJECT RECORD DOCUMENTS

- A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is significantly at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various major and minor feeders, equipment, and other pertinent items, as installed. Record underground and under-slab cables installed, dimensioning exact location and elevation of such installations.
- B. At conclusion of project, obtain without cost to the Owner, electronic AutoCAD 2014 or later / Revit CAD files of the original drawings and transfer as-built changes to these. Provide the following as-built documents including all contract drawings regardless of whether corrections were necessary and include in the transmittal: "2 sets of CDs and prints for Owner's use, one set of CDs, prints, and mylars for Architect / Engineers Records". Delivery of these as-built electronic, reproducible and prints is a condition of final acceptance.
 - 1. 3 sets of electronic AutoCAD (2014 dwg or later) / Revit CAD drawing files, on CD-ROM media, of each contract as-built drawing.
 - 2. One reproducible Dayrex mylar film positive of each contract as-built drawing.
 - 3. Three sets of blue or black-line prints of each contract as-built drawing.
- C. As-Built Drawings should indicate the following information as a minimum:
 - 1. Indicate all addendum changes to documents.
 - 2. Remove Engineer's Seal, name, address, and logo from drawings.
 - 3. Mark documents AS-BUILT DRAWINGS.
 - 4. Clearly indicate: DOCUMENT PRODUCED BY:
 - 5. Indicate all changes to construction during construction. Indicate actual routing of

- 6. all conduit and cables, etc that were deviated from construction drawings. Indicate exact location of all underground communications raceways, and elevations.
- 7. Correct schedules to reflect (actual) equipment furnished and manufacturer.
- 8. During the execution of work, maintain a complete set of Drawings and specifications upon which all locations of equipment, devices, and all deviations and changes from the construction documents in the work shall be recorded.
- 9. Exact location of all communications equipment in building. Label panel schedules to indicate actual location.
- 10. Exact location of all communications equipment in and outside of the building.
- 11. Location, size and routing of all communications cables, conduits, equipment, etc. shall be accurately and neatly shown to dimension.
- 12. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
- 13. Cloud all changes.

1.26 OPERATING TESTS

- A. After all communications systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect / Engineer and Owner. Provide minimum 24-hour advance notice of scheduling of all tests. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.27 WARRANTY

- A. All equipment shall be covered for the full manufacturers warranty period and systems shall be warranted by the Contractor for a period of two years commencing with the filing date of substantial completion. The Warranty shall cover all costs for warranty service, including parts, labor, prompt field service, pick-up, transportation, delivery, reinstallation, and retesting. A contract for service shall cover the period starting with the first expected activation of each system and shall continue without interruption to cover the period to the end of the two-year warranty as defined above. The end of the warranty period shall be handled such that a smooth transition to a maintenance agreement with the Owner shall be achieved with no lapse in coverage.
- B. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.28 BUILDING CONSTRUCTION

- A. It shall be the responsibility of the sub-contractor to consult the Architectural and Engineering drawings, details and specifications and thoroughly familiarize himself as to the construction and all job-related requirements. All construction trades shall cooperate with the General Contractor / Construction Manager job site superintendent and lay out work so that all piping, cables, pathways, raceways, and other items are placed in the walls, furred spaces, chases, etc., so that there shall be no delay in the job.

1.29 TEMPORARY FACILITIES

- A. General: Refer to Division 01 for general requirements on temporary facilities.
- B. Temporary Wiring: Temporary power and lighting for construction purposes shall be provided under Division 26. Installation of temporary power shall be in accordance with NEC Article 305.

- C. Temporary facilities, wire, lights and devices are the property of this Contractor and shall be removed at the completion of the Contract.

1.30 EXTRA MATERIALS

- A. Keys: Provide three (3) sets of all keys for system cabinets.

PART 2 - PRODUCTS

2.1 WORK INCLUDED

- A. All materials listed in PART 2 - PRODUCTS of this Division Sections and on the Drawings shall be provided by the Contractor unless specifically excluded or modified in other portions of this Specification or Addendums.

2.2 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

- A. Materials, in general, shall conform to the National Electrical Code requirements and shall be listed, inspected, and approved by the Underwriters Laboratories and shall bear the UL label where labeling service is available. The label or listing of the Underwriters Laboratories, Inc. will be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this listing, the Contractor may submit a statement from a nationally recognized, adequately equipped testing agency, indicating that the items have been tested in accordance with required procedures, and that the materials and equipment comply with all Contract requirements.

2.3 STANDARD PRODUCTS

- A. Materials and equipment shall be the standard catalog products of manufacturers regularly engaged in the manufacture of products conforming to these specifications and shall essentially duplicate materials and equipment that have been in satisfactory use at least two (2) years prior to bid opening. Where custom or special items are required, these shall be fully described using drawings, material lists, etc., which fully describe in detail the item proposed for use on this project.

2.4 MANUFACTURE'S INSTRUCTIONS

- A. The Contractor is responsible for furnishing the proper Communication equipment and/or material and for seeing it is installed as intended by the manufacturer. The Contractor shall, wherever necessary, request advice and supervisory assistance from equipment manufacturers as required for the proper installation, operation, or start-up. The Contractor shall notify the Consultant, in writing, of any conflict between the Contract Documents and the manufacturer's recommendations and shall obtain, from the Consultant, instructions/direction before proceeding with the work. The Contractor shall pay for all costs resulting from deficiencies created by installation not in accordance with the manufacturer's recommendations or the instructions of the Consultant.

2.5 RUST PREVENTION

- A. Metallic materials shall be protected against corrosion. Exposed metallic parts of equipment exposed to the elements shall be given a rust inhibiting treatment and standard finish by the manufacturer. Components such as boxes, bodies, fittings, guards, and miscellaneous parts shall be protected in accordance with the ASTM A123 or A153, except where other equivalent protective treatment is specifically approved in writing.

2.6 STORAGE AT SITE

- A. The Contractor shall not receive material or equipment at the job site until ready for installation or until there is suitable space provided to properly protect equipment from rust, weather, humidity, dust, or physical damage.

- B. All electronic equipment, containing sealed lead acid batteries or gel cells, shall be stored in climate-controlled area until installed or reinstalled. Do not store in non-climate controlled connex storage units.
- C. Storage is to be provided and secured by the contractor. In the event that the Owner should agree to furnish storage space, security of the space and its contents shall remain the responsibility of the contractor.

2.7 CONDITION OF MATERIALS

- A. All materials required for the installation of the Communication systems shall be new and unused. Any material or equipment damaged in transit from the factory, during delivery to premises, while in storage on premises, while being installed, or while being tested, until time of final acceptance, shall be replaced by this Contractor without extra cost to Owner.

2.8 NAMEPLATES

- A. Factory assembled components and equipment shall be provided with be factory stamped labeling. Labeling will have information required to specifically identify the component and/or equipment in the future such as the manufacturer's name, catalog number, serial number, etc. All data on the labels shall be legible at the time of final inspection.

2.9 ACCESS DOORS

- A. Wherever access is required in walls or ceilings to concealed junction boxes, pull boxes, equipment, etc., installed under this Division, furnish a hinged access door and frame with flush latch handle to another Division for installation. Doors shall be as follows:
 - 1. Plaster Surfaces: Milcor Style K.
 - 2. Ceramic Tile Surfaces: Milcor Style M.
 - 3. Drywall Surfaces: Milcor Style DW.
 - 4. Install panels only in locations approved by the Architect.

2.10 SPACE LIMITATIONS

- A. Equipment shall be chosen which shall properly fit into the physical space provided and shown on the drawings, allowing ample room for access, servicing, removal and replacement of parts, etc. Adequate space shall be allowed for clearances in accordance with applicable codes and standards. Physical dimensions and arrangement of equipment shall be subject to the approval of the Consultant.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. This project has a critical path, which must be closely followed in order to meet the completion date. The Contractor shall review the proposed schedule at the Award of Contract meeting and be prepared to staff his work force according to the schedule constraints presented at that time.
- B. Aesthetics are an important consideration in this installation. All components shall be installed so as to have aesthetically pleasing results as determined by the Owner and Architect. Actual locations of all visible components shall be coordinated in advance with the Owner and Architect.
- C. Install, make fully operational and test the system as indicated on the Drawings and in the Specifications. Where information is not available the worst-case condition must be assumed to ensure a complete, functional system.
- D. Any interfacing with other systems shall be the Contractor's responsibility under this contract, and the details, both logical and physical, of such interfaces shall be reflected in the Submittals and As-Built drawings.

- E. If appropriate, interfaces with the Owner's Data Network, Telecommunications and Communications System shall be coordinated with the Owner and Architect.
- F. All necessary back boards, back-boxes, pull-boxes, connectors, supports, conduit, cable and wire shall be furnished and installed to provide a complete and reliable system. Exact location of all backboards, boxes, conduit and wiring runs shall be presented to the Owner / Architect for approval in advance of any installation. Provide as required and as specified in Division 26.
- G. Where required provide 120-VAC, 60 Hz power from nearest electrical panel through a junction box, to the system devices. Provide as required and as specified in Division 26.
- H. Where required, install conduit, cable and wire parallel and square with building lines, including raised floor areas. Conduit fills shall not exceed 40%.
- I. Ground busses shall be provided in each any room with communication equipment.
- J. All equipment shall be mounted with sufficient clearance to minimize EMI as well as meet all applicable codes and facilitate observation and testing. Securely hand and/or fasten with appropriate fittings to ensure positive grounding, free of ground loops, throughout the entire system. Units shall be installed parallel and square to building lines.
- K. Communications grounding system shall be a single point grounding from the building entrance electrical ground to each Communications room.
- L. All Conduit systems, cabinets' racks, cable trays, protector blocks, SCTP patch panels and/or miscellaneous equipment, etc. shall be grounded by being connected to the common communications grounding system. The conductors shall be a # 6awg solid with a green jacket
- M. Quiet and vibration-free operation of all equipment is a requirement of this installation. Properly adjust, repair, balance or replace any equipment producing objectionable (in the judgment of the Owner or Architect) noise or vibration in any of the occupied areas of any building and provide additional brackets and bracing if necessary. Any such additions or changes shall be at no additional cost to the Owner.
- N. Installation shall comply with the CODES AND STANDARDS portion of this Section. Where more than one code or regulation if applicable, the more stringent shall apply.
- O. Where new equipment is replacing old equipment, the Contractor is responsible for removing and disposing of the old equipment and doing whatever repair work is necessary as specified by the Owner / Architect.
- P. Install firestopping, as specified in Division 26 for all penetrations in slabs and firewalls to meet code at the completion of work and prior to final testing demonstration to the Owner.
- Q. The installation shall be performed in a professional manner.
- R. On a daily basis, clean up and deposit in appropriate containers all debris from work performed under the appropriate specification sections. Stack and organize all parts, tools and equipment when not being used.
- S. Preparation, handling and installation shall be in accordance with the Manufacturer's written instructions and technical data appropriate to the product specified.
- T. All work shall conform to the National Electrical Contractor's Association "Standard of Installation" for general installation practice.
- U. At the conclusion of the installation, all work areas, including all enclosures and boxes, shall be vacuumed and cleaned to remove all debris and grease.

3.2 COORDINATION WITH OWNER / ARCHITECT

- A. Close coordination with the Owner / Architect is vital to achieve a complete, aesthetically pleasing job. The Contractor shall ensure that the Owner / Architect is kept fully apprized of job progress.

3.3 CUTTING, PAINTING, AND PATCHING

- A. Structural members shall not be drilled, bored or notched in such a manner that shall impair their structural value. Cutting of holes in structural members, if required, shall be done with core drills and only with the specific approval of the Owner / Architect for each instance.
- B. All walls that require cutting or repair during the installation process shall be returned to their original condition, including the matching of colors and finishes to the satisfaction of the Owner / Architect, and at no additional cost to the Owner.

3.4 WIRE AND CABLE

- A. All low voltage cable shall be low smoke plenum rated, limited energy, with 300-volt insulation.
- B. All wires in exposed areas shall run through conduit as specified in Division 26.
- C. Provide conduits, cable trays, raceways, wireways, boxes and outlets as specified in Division 26.
- D. After installation, and before termination, all wiring shall be checked and tested to insure there are no grounds, opens, or shorts on any conductors. In addition, all wires between buildings or underground and all coax cables shall have insulation tested with a megohmmeter (megger) and a reading of greater than 20 megohms shall be required to successfully complete the test.
- E. Run wires continuously from termination to termination without splices.
- F. Wire and cable shall be supported in each equipment and terminal cabinet and in each terminal and pull box in vertical risers and horizontal runs with wire duct and strap-type supports. At any point where wire duct is required for good wire management, whether shown on elevations or not, install appropriate duct. Where terminal boards are used, wire ducts shall be supplied on both sides and at no time shall wires cross over terminal boards. Arrange cables neatly to allow inspection, removal and replacement. Lace cables as required. Spot tie wire bundles with plastic cable ties and securely affix to panels. If screw type terminals are specified, terminal strip connections shall be locking, tongue style, pressure crimp, and solderless spade lug.
- G. Visually inspect wire and cable for faulty insulation prior to installation. Protect cable ends at all times with acceptable end caps except during actual termination. At no time shall any coaxial cable be subjected to a bend less than a 6-inch radius. Protect wire and cable from kinks. Install 1 pull rope for all 2" or larger sized conduits.
- H. Provide plastic bushings and strain relief material at all conduit exit points and where necessary, to avoid abrasion of wire and excess tension on wire and cable.
- I. Cables above accessible ceilings shall not rest on ceiling tiles. Use Velcro tie wraps, J-hooks or D-rings to hold cables. Provide independent support for all cables. Support is to be from building structure (do not support from pipes or conduits). Communications cables shall not tie off on HVAC supports, all-thread, ceiling grid hanger wire or electrical / mechanical piping system.
- J. Ground and bond equipment and circuits in accordance with NEC and Division 26.

3.5 IDENTIFICATION AND TAGGING

- A. All cables, wires, wiring forms, terminal blocks and terminals shall be identified by labels, tags to other permanent markings in accordance with TIA/EIA-606. The markings shall clearly indicate the function, source, or destination of all cabling, wiring and terminals. All cables and wires shall be identified, utilizing heat-shrink, machine printed, polyolefin wire markers (Brady Type B-32 *or equal*). Handwritten tags are not acceptable.
- B. Should a situation arise where the wire tagging format as shown on the drawings cannot be used, a substitute format shall be submitted which complies with the intent to provide documentation that will permit end-to-end tracing of all Communications Systems wiring.

- C. All panels shall be provided with permanently attached engraved lamacoid labels with identifying names and functions. All terminal points shall be appropriately labeled. Labels shall be consistent in form, color, and typeface throughout the system and all must contain the name of the system or subsystem as part of the label textual information. Design, color, font and layout shall be coordinated with, and approved by, the Owner.
- D. Identification of Equipment:
 - 1. All major equipment shall have a manufacturer's label identifying the manufacturer's address, equipment model and serial numbers, equipment size, and other pertinent data. Take care not to obliterate this nameplate. The legend on all nameplates or tags shall correspond to the identification shown on the Operating Instructions.
 - 2. A black-white-black 3 layer laminated plastic engraved identifying nameplate shall be permanently secured to each wireway, terminal cabinet, and communications (voice, data, video) cabinet or rack.
 - a. Identifying nameplates shall have 1/2-inch high, engraved letters. For equipment designation and 1/4-inch letters indicating source circuit designation, (i.e.: "IDF(FCR) XXYY –served from MDF (BCR) XXGG).
 - 3. Permanent, waterproof, black markers shall be used to identify each communications grid junction box, clearly indicating the type of system available at that junction box.
 - 4. Pull Boxes: Field work each with a nameplate showing identity, and identifying equipment connected to it. Nameplates shall also indicate where pull box is fed from.
 - 5. Communication hardware located above accessible ceilings: Provide 1/2-inch high black name plate with white 1/4-inch letters glued to bottom of t-grid ceiling below hardware located above ceiling. Identification shall be as short as possible yet identifying device above ceiling, i.e. "A/V-EQ".
- E. Prohibited Markings: Markings intended to identify the manufacturer, vendor, or other source from whom the material has been obtained are prohibited for installation in public, tenant, or common areas within the project. Also prohibited are materials or devices that bear evidence that markings or insignias have been removed. Certification, testing (example, Underwriters Laboratories), and approval labels are exceptions to this requirement.
- F. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of communications facilities. Provide text of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with industry standards for color and design.
- G. Wire and Cable Labeling: Provide wire markers on each conductor in all boxes, pull boxes, gutters, wireways. Identify with drop/circuit number.
- H. Underground Warning Tape: Thomas and Betts or approved equal. Six-inch wide plastic tape, colored red or orange with suitable warning legend describing buried communications lines. All underground conduits shall be so identified. Tape shall be buried at a depth of 6-inches below grade and directly above conduits or ductbanks. Provide magnetic marking tape below all underground conduits.

3.6 CUTTING AND PATCHING

- A. General: Comply with the requirements of Division 01 for the cutting and patching of other work to accommodate the installation of electrical work. Except as authorized by the Architect / Engineer, cutting and patching of electrical work to accommodate the installation of other work is not permitted.

3.7 INSTRUCTION OF OWNER'S PERSONNEL

- A. Before proceeding with the instruction of Owner Personnel, prepare a typed outline in

triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.

- B. Prior to substantial completion, conduct an on-site training program to instruct Owner's operating personnel in the operation and maintenance of the communications systems.
 - 1. Provide the training during regular working day.
 - 2. The Instructors shall be experienced in their phase of operation and maintenance of the systems and with the project.
- C. Time to be allocated for instructions.

The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel. The Owner's operator training shall include training as specified per system specification,

 - 1. Minimum of four (4) hours dedicated instructor time
 - 2. 2-hour sessions on different, non-consecutive days
 - 3. Additional instruction time for specific systems as specified in other Sections.
- D. Before on-site training, submit the program syllabus; proposed time and dates; for review and approval, minimum 48 hours prior to proposed training time and date.
 - 1. One copy to the Owner
 - 2. One copy to the Architect / Engineer
- E. The Owner shall provide a list of personnel to receive instructions and shall coordinate their attendance at the agreed upon times.
- F. Use operation and maintenance manuals as the basis of instruction. Review manual with personnel in detail. Explain all aspects of operation and maintenance.
- G. Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, maintenance, and shut down of each item of equipment.
- H. Demonstrate equipment functions (both individually and as part of the total integrated system).
- I. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.
- J. Submit a report within one week after completion of training. List time and date of each demonstration, hours devoted to the demonstration, and a list of people present, with their respective signatures.
- K. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.
- L. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.8 OPENINGS

- A. Framed, cast or masonry openings for boxes, equipment or conduits are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.9 OBSTRUCTIONS

- A. The drawings indicate certain information pertaining to surface and subsurface obstructions, which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
 - 1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that

- all available information has been provided.
2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
- B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.10 VANDAL RESISTANT DEVICES

- A. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used.
- B. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.11 PROTECTION

- A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.
- B. Do not deliver equipment to this project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather shall be rejected, and the contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

3.12 EQUIPMENT BACKBOARDS

- A. Backboards: ¾ inch, fire retardant, exterior grade plywood, painted gray, both sides.
 1. Provide minimum of two 4-ft. by 8-ft. sheets of plywood for each location shown.
 2. Provide minimum of two 4-ft. by 4-ft. sheets of plywood for each communications location.

3.13 SITE MANAGEMENT RESPONSIBILITY

- A. The Contractor shall provide an on-site Project Manager as defined in CONTRACTOR'S QUALIFICATIONS portion of this Section.

3.14 DEMOLITION AND RELOCATION

- A. The Contractor shall modify, remove, and relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain as directed by the Owner. Materials and items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to the approval of the Owner. The Contractor may substitute new materials and items of like design and quality in lieu of materials and items to be relocated, if approved by the Owner.
- B. All items scheduled for relocation and/or reuse shall be inspected by the Contractor and the Owner or his authorized representative. A written report of the condition of each item shall be made and provided to the Consultant. Where items scheduled for relocation and/or reuse are considered unsuitable for reuse, the Contractor shall so notify the Consultant and await reinstallation instructions before proceeding with removal. Items damaged in reinstallation shall be repaired or replaced by the Contractor as directed by the Owner at no additional cost to the Owner or the Consultant.
- C. All items which are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean, repair, and provide all new materials, fittings, and appurtenances required to complete the relocation and to restore the items to good operative order. All relocations shall be

performed by workmen skilled in the work and in accordance with standard practice of the trades involved.

- D. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points as indicated on the drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied off or connections into the existing facilities in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific written approval of the Consultant.

3.15 EXISTING SYSTEM TESTING

- A. Contractor shall have each low voltage system tested prior to the commencement of construction. Systems shall include all systems that fall under the Division 27 umbrellas, as identified in the Division 27 of the Construction Specifications Institute (CSI) current Master Format . Test shall include the functionality of all field devices and equipment. Any failures or items found to be functioning not to specification, shall be reported prior to construction. Any items found to be improperly or non-functioning upon the completion of the project, shall be replaced and/or repaired, by the contractor, at no additional cost to the project or the owner.
- B. Contractor shall document the location and any ID tag, MAC address, IP address, or bar code of any existing device that is to be removed from its current location. Devices that are to remain, shall be reinstalled in the exact location that they reside in prior to construction, unless noted otherwise.
- C. Any individual/firm that will be removing, relocating, reinstalling, or tampering with any devices; shall be licensed by the state and certified by the manufacturer of the system.
- D. Contractor shall remove any devices where construction occurs to prevent possible damage to the device. Removal of any devices which support user connection or other systems, shall be coordinated with the owner prior to removal and/or taking offline.

3.16 START-UP RESPONSIBILITY

- A. The Contractor shall initiate System operation. The Contractor shall provide competent Start-Up personnel on each consecutive working day until all Communications Systems are functional and ready to start the acceptance test phase. If the Contractor, in the Owner / Architect's judgment, is not demonstrating progress in solving any technical problems, the Contractor shall supply Manufacturer's factory technical representation and diagnostic equipment at no cost to the Owner, until resolution of those defined problems. Where appropriate, the Contractor shall bring the Systems on-line in their basic state (i.e., alarm reporting, facility code access control, etc.) It is the responsibility of the Owner to provide the specific database information that will be utilized for initial system programming.
- B. Properly ground each piece of electronic equipment prior to applying power. Properly ground all shielded wire shields to the appropriate earth ground at the hub end only, not at the remote or device end.
- C. Use a start-up sequence that incrementally brings each portion of the system on-line in a logical order that incorporates checking individual elements before proceeding to subsequent elements until the entire system is operational. The basic steps should include:
 - 1. Establish ground planes at the equipment rooms and hub end of the systems as specified in Division 26.
 - 2. Disconnect power, connect the first device, reconnect power, and verify operational correctness. Repeat until the entire system is verified and operational.

3.17 PREPARATION FOR ACCEPTANCE (SUBSTANTIAL COMPLETION)

- A. All systems, equipment, and devices shall be in full and proper adjustment and operation, and properly labeled and identified.
- B. All materials shall be neat, clean and unmarred, and parts securely attached.
- C. All extra material as specified shall be delivered and stored at the premises as directed.
- D. Test reports of each system and each system's components and As-Built Project Drawings shall be complete and available for inspection and delivery as directed by the Owner.

3.18 SYSTEM ACCEPTANCE REQUIREMENTS

- A. Before final acceptance or work, the Contractor shall perform and/or deliver each of the following in the order stated.
- B. The Contractor shall deliver three (3) composite "System Operations and Maintenance" manuals in three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain in appropriately tabbed sections:
 - 1. A statement of Guarantee including date of termination and the name and phone number of the persons to be called in the event of equipment failure.
 - 2. A set of Operating procedures for the overall System that includes all required Owner activities, and that allows for the Owner operation of all attributes and facilities of the System.
 - 3. A section for each specific type of equipment containing the vendor manuals, instruction sheets, and any related literature that came in the original shipping container for that piece of equipment. Include all warranty cards.
- C. Testing:
 - 1. The Contractor shall perform all tests required by Division 26 and those submitted as part of this Section.
 - 2. The Contractor shall activate all devices for proper system operation, including supervisory and trouble circuit tests. Similarly, audible alarms will not be activated except on a one-time, coordinated basis, to check the actual sounding devices.
 - 3. A test report for each piece of equipment shall be prepared by the Contractor and submitted to the Owner. This report shall include a complete listing of every device, the date it was tested, by whom and the results. The final test reports shall indicate that every device tested successfully. Failure to completely test and document the tests will result in a delay of final testing and acceptance.
- D. As-Built Drawings:
 - 1. After completion of all the tests listed above, and prior to the final acceptance test, The Contractor shall submit the complete As-Built drawings as identified in PART 1 – PROJECT RECORD DRAWINGS.
 - 2. The final As-Built Drawings shall consist on one set of reproducible prints, two (2) sets of Point-to-Point Detail Drawings, Equipment Schedules, and the complete detailed technical data that was shipped by the manufacturer with all installed equipment.
- E. Final Acceptance Test: The Final Acceptance Test shall demonstrate the installed and activated System's performance and compliance with System Specifications. However, before this testing can begin the following must have received and reviewed by the Owner.
 - 1. System Operations and Maintenance Manuals
 - 2. System Test Reports
 - 3. As-Built Drawings

3.19 FINAL ACCEPTANCE

- A. The date of final acceptance shall be the date of owner occupancy, or the date all punch list items have been completed or final payment has been received. Refer to Division 1 for additional requirements
- B. When the Final System Acceptance Requirements described above including the Final Acceptance Test described above have been satisfactorily completed. The Owner / Architect shall issue a Letter of Completion to the Contractor indicating the date of such completion. The Notice of Completion shall be recorded by the Contractor upon receipt of the Owner / Architect completion letter. This date of record shall be the start of the warranty period.

END OF SECTION

SECTION 27 0507
COMMUNICATIONS SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Prepare submittals as required by Division 01 and as outlined below.
- B. Submit product data shop drawings only for the following and for items specifically requested elsewhere in the Contract Drawings and Specifications. Architect / Engineer reserves the right to refuse shop drawings not requested for review and to imply that materials shall be provided as specified without exception.
- C. The term submittal, as used herein, refers to all:
 - 1. Shop Drawings
 - 2. Coordination Drawings
 - 3. Product data
- D. Submittals shall be prepared and produced for:
 - 1. Distribution as specified
 - 2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

- A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
- B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.
- C. Identify field dimensions; show relation to adjacent or critical features or work or products.

1.3 COORDINATION DRAWINGS

- A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: 1/4"=1'-0".
- B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
- C. For each room containing technology equipment and each rack with technology equipment, submit plan and elevation drawings. Show:
 - 1. Actual technology equipment and components to be furnished.
 - 2. NEC working space and NEC access to NEC working space.
 - 3. Relationship to other equipment and components and openings, doors and obstructions
 - 4. Rack location and dimensions
- D. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- E. Verify location of communications station devices, telephone outlets and other work specified in this Division.
 - 1. Coordinate with drawing details, site conditions and millwork shop drawings prior to installation.
 - 2. Where required for clarification, submit shop drawings prior to rough-in and fabrication.
- F. Submit shop drawings in plan, elevation and sections, showing outlets and other devices in casework, cabinetwork and built-in furniture.

1.4 PRODUCT DATA

- A. All product options specified shall be indicated on the product data submittal. All options

listed on the standard product printed data not clearly identified as not part of the product data submitted shall become part of the Contract and shall be provided.

- B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.
- C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.
- D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
- E. Mark up a copy of the specifications for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:)

1.5 MANUFACTURERS INSTRUCTIONS

- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up and adjusting.

1.6 CONTRACTOR RESPONSIBILITIES

- A. Review submittals prior to transmittal.
- B. Determine and verify:
 - 1. Field measurements
 - 2. Field construction criteria
 - 3. Manufacturer's catalog numbers
 - 4. Conformance with requirements of Contract Documents
- C. Coordinate submittals with requirements of the work and of the Contract Documents.
- D. Notify the Architect / Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
- E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.
- F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.
- G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect / Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.
- H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
 - 1. Proper sizes and capacities
 - 2. That the item will fit in the available space in a manner that will allow proper service
 - 3. Construction methods, materials and finishes
- I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.7 SUBMISSION REQUIREMENTS

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.
- B. Number of submittals required:

1. Shop Drawings and Coordination Drawings: Submit four opaque reproductions.
 2. Product Data: Submit the number of copies the contractor requires, plus those to be retained by the Architect / Engineer.
- C. Accompany submittals with transmittal letter, in duplicate, containing:
1. Date
 2. Project title and number
 3. Contractor's name, address and telephone number
 4. The number of each Shop Drawing, Project Datum and Sample submitted
 5. Other pertinent data
- D. Submittals shall include:
1. The date of submission
 2. The project title and number
 3. Contract Identification
 4. The names of:
 - a. Contractor
 - b. Subcontractor
 - c. Supplier
 - d. Manufacturer
 5. Identification of the product
 6. Field dimensions, clearly identified as such
 7. Relation to adjacent or critical features of the work or materials
 8. Applicable standards, such as ASTM or federal specifications numbers
 9. Identification of deviations from contract documents
 10. Suitable blank space for General Contractor and Architect / Engineer stamps
 11. Contractor's signed and dated Stamp of Approval
- E. Coordinate submittals into logical groupings to facilitate interrelation of the several items.
1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
 2. Associated items requiring correlation for efficient function or for installation

1.8 SUBMITTAL SPECIFICATION INFORMATION

- A. Every submittal document shall bear the following information as used in the project manual:
1. The related specification section number
 2. The exact specification section title
- B. Submittals delivered to the Architect / Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.9 RESUBMISSION REQUIREMENTS

- A. Make resubmittals under procedures specified for initial submittals.
1. Indicate that the document or sample is a resubmittal
 2. Identify changes made since previous submittals
- B. Indicate any changes which have been made other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

- A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
- B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect / Engineer that Contractor has either determined and verified all

quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

- C. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's stamp of approval and signature.
- D. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

- A. The Architect / Engineer will:
 - 1. Review identified submittals with reasonable promptness and in accordance with schedule. Specific equipment submittals that may be required to be expedited shall be submitted separately without other submittal items not requiring the same prompt attention.
 - 2. Affix stamp and initials or signature, and indicate requirements for resubmittal or approval of submittal
 - 3. Return submittals to Contractor for distribution or for resubmission
- B. Review of submittals will not extend to design data reflected in submittals that is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.
- C. Architect / Engineer's review is only for conformance with the design concept of the project and for compliance with the information given in the contract.
 - 1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
 - 2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.
- D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

- A. Do not make requests for substitution employing the procedures of this Section.
- B. The procedure for making a formal request for substitution is specified in Division 1.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 SHOP DRAWINGS AND PRODUCT DATA

- A. Submittals shall not be combined or bound together with any other material submittal.
- B. Submit individually bound shop drawings and product data for the following when specified or provided:
 - 1. Structural Cabling
 - 2. Communications System
 - 3. Sound Reinforcement System
 - 4. CATV System

3.2 COORDINATION DRAWINGS

- A. Submit coordination drawings as specified.

END OF SECTION

SECTION 27 0509
CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.2 QUALITY CONTROL PROGRAM

- A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes to match approved samples; all exposed finishes shall be approved by the Architect / Engineer. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide a manufacturer's qualified personnel to observe:
 - 1. Field conditions.
 - 2. Condition of installation.
 - 3. Quality of workmanship.
 - 4. Start-up of equipment.
 - 5. Testing and adjusting of equipment.
- B. Manufacturer's qualified personnel shall make written report of observations and recommendations to Architect/Engineer.

1.7 MOCK UPS

- A. Assemble and erect the specified equipment and products complete, with specified anchorage and support devices, seals and finishes.
- B. Do not proceed with any work involving a mock-up, until the related mock up has been approved in writing.
- C. Acceptable mock-ups in place shall be retained in the completed work where possible.
- D. Perform tests and submit results as specified.

1.8 SCHEDULING OF MOCK-UPS

- A. Schedule demonstration and observation of mock-ups, in phases, with Architect / Engineer.

1. Rough-in
2. Finish with all appurtenances in place
3. Demonstrations

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.

PART 3 - EXECUTION

3.1 ADJUSTMENTS AND MODIFICATIONS

- A. Contractor shall provide all adjustments and modifications as requested by the manufacturer's qualified personnel at no additional cost to Owner.

3.2 MOCK-UPS

- A. Mock-up a typical classroom, science lab of each type, and computer lab with all wiring devices, cover plates, rough-in boxes, conduits, etc. Provide all conductors from all wiring devices to above ceiling space to demonstrate conduit routing and conductor fill.

END OF SECTION

**SECTION 27 0534
PATHWAYS AND INFRASTRUCTURE FOR AV SYSTEMS**

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section describes and specifies infrastructure devices associated with Div. 27 4115 Performance Audio-Visual Systems and Equipment:

1.02 DESCRIPTION OF THE WORK

- A. Conduit pathways
- B. Backboxes, Junction Boxes, and Pull Boxes
- C. Cable support devices

1.03 SCOPE OF THE WORK

- A. All Audiovisual Infrastructure devices listed in this Section shall be provided and installed by the Division 26 Electrical Contractor.
- B. Conduit and containment pathways and terminations: Refer to associated AV-series Audiovisual Infrastructure drawings for conduit pathway scope, notes, and requirements.
- C. All enclosures, as listed in the Audiovisual Device Legend in the associated AV-series Audiovisual drawing package, shall be furnished and installed by the Division 26 Electrical Contractor:
 - 1. Specialty enclosures and / or Custom enclosure configurations are listed in this Specification Section.
 - 2. Common enclosures and junction boxes are explicitly called out in the Audiovisual Device Legend in the associated AV-series Audiovisual Infrastructure drawing package and are not restated here.
- D. Performance Audio-Visual Systems and Equipment to be supplied under separate Section (27 4115).

1.04 RELATED DOCUMENTS

- A. The general provisions of the contract, including General Provisions, Supplemental Conditions, and Division 1 – General Requirements, apply to the work specified in this section.
- B. Refer to the associated AV-series Audiovisual drawings for additional information, notes, and exact locations pertaining to Infrastructure devices associated with Performance Audio-Visual Systems and Equipment.

1.05 RELATED SECTIONS

- A. Refer to Division 26 Electrical Drawings and Audiovisual AV-series drawings related to Division 26 electrical for coordination of conduits, pull wires, and connections to electrical power. All conduits, junction boxes, floor boxes and power are by Division 26. Refer to Electrical drawings for all power, and all pathways associated with such power, for Audiovisual systems.
- B. All conduits, junction boxes, and floor boxes associated with Audiovisual System devices shall be provided and installed by the Division 26 Electrical Contractor. Refer to AV-Series Audiovisual drawing sheets for all pathway requirements.

1.06 SUBSTITUTIONS

- A. Refer to Division 1 for specific substitution procedures and submittal requirements.
- B. Many items are listed in the Specifications by the manufacturer's type or model number, without a detailed performance specification, and may not include the phrase "or approved equal". Where this is the case, no substitutions will be accepted, without a written request from the Installer and the written consent of the Consultant and the Owner.
- C. Where the phrase "or approved equal" appears, the item specified shall set a standard of quality and performance, based on the published specifications of the manufacturer and on the actual performance as known by the Consultant.
- D. Requests for substitution, when forwarded by the Installer to the Consultant and Owner, are understood to mean that the Installer represents that he has personally investigated the proposed substitute product and determined that it is equal to or superior in all respects to that specified, that the same guarantee will be provided for the substitution as for the specified product, and that the Installer will coordinate the installation of the accepted substitute, making such changes as may be required for the work to be complete in all respects.
- E. Substitutions will not be considered if they are indicated or implied in Shop Drawing submissions without previous formal request, or, for their implementation, they require a substantial revision of the Contract Documents in order to accommodate their use.
- F. Space allocations and utility rough-ins have been designed on the basis of equipment items named by manufacturer and model number. If any equipment not so named is offered which differs substantially in dimension or configuration from the named equipment, provide scaled shop drawings showing that the substitute can be installed in the space available without interfering with other trades or with access for operation and maintenance in the completed project. The Installer shall coordinate final utility rough-in locations with actual equipment furnished.
- G. Where substitute equipment requiring different arrangement or connections from those shown in the drawings is accepted by the Consultant, install the equipment to operate properly and in harmony with the intent of the Drawings and Specifications, making all necessary incidental changes without increasing the Contract amount. Pay all additional costs incurred by adjoining or connecting trades.
- H. All requests for substitutions shall be submitted 2 weeks prior to the bid opening date. Substitutions shall be requested and approved in writing only, based upon these criteria.

1.07 COOPERATION AND COORDINATION

- A. Cooperate and coordinate as required with the other contractors who are responsible for work not included in this section.
- B. Provide any and all information as required or requested by the Owner, Architect/Engineer, Consultant, or General Contractor in order for this work to be completed to the satisfaction of the Owner, and in the best interests of the Project. Such assistance or information shall be transmitted in writing to the requesting party in all cases. All written correspondence shall be copied to the Consultant.

1.08 GUARANTEE AND WARRANTY

- A. Guarantee all parts, labor, and workmanship furnished under this contract for a period of twelve months from the date of substantial completion.
- B. During the warranty period, report to the site and repair or replace any defective materials or workmanship without cost to the Owner. Warranty service shall be rendered within 48 hours after request by the Owner. Equivalent replacement equipment shall be temporarily provided when immediate on-site repairs cannot be made.

- C. Where warranties on individual pieces of equipment exceed twelve months, the guarantee period shall be extended to the warranty period of the particular items.

1.09 SUBMITTALS

- A. Equipment lists, data sheets, etc. shall be 8-1/2" x 11" size, properly bound into a single or multiple volumes as necessary, and also submitted in electronic PDF format. Submit quantity in accordance with Division 1, General Requirements.
- B. Within 45 days after the notice to proceed, submit to the Architect/Engineer identical copies of the following for approval:
1. A complete equipment list, with manufacturers' names, model numbers, and quantities of each item;
 2. Manufacturers' data sheets on all equipment items;
 3. Floor plans and reflected ceiling plans, prepared at a scale not less than 1/8" = 1'-0", showing device locations and orientation for all items in scope;
 4. Riser diagrams showing conduit requirements, to include all pull boxes and outlet boxes;
 5. Proposed construction details for all devices in this Specification Section. These details shall show dimensions, materials, finishes and color selection;

1.10 JOB CONDITIONS

- A. Coordinate installation of mounts, back-boxes, floor boxes and all other devices specified in this Section with work of other trades.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All items shall be new and unused. The following articles specifically list the acceptable items for this project. Where quantities are not noted, they may be obtained from the associated drawings. In the event of a discrepancy between the specifications and the drawings, the greater quantity or better quality shall be furnished.

2.02 SURFACE-MOUNTED WALL BOXES

- A. Furnish and install surface-mounted wall boxes at the locations indicated in the drawings.
- B. Specified devices shall have a perimeter dimension which exceeds that of standard gang size cover plates, in order to prevent sharp corner edges of those plates from protruding beyond the box profile.
- C. Furnish and install the following, or approved equal, at locations indicated in the associated AV-series drawings:
1. 1-Gang: FSR, Inc SMWB-1G-BLK (part# 17186) 1-gang surface mount gang box, black. (Qty: as shown)
 2. 2-Gang: FSR, Inc SMWB-2G-BLK (part# 17188) 2-gang surface mount gang box, black. (Qty: as shown)
 3. 3-Gang: FSR, Inc SMWB-3G-BLK (part# 17190) 3-gang surface mount gang box, black. (Qty: as shown)
 4. 4-Gang: FSR, Inc SMWB-4G-BLK (part# 17192) 4-gang surface mount gang box, black. (Qty: as shown)

2.03 CABLE SUPPORT DEVICES

- A. Select requirements from this Article or revise to suit Project.
- B. Furnish and install cable support devices for use with routing Audiovisual cabling at Audiovisual equipment and production locations as shown.
- C. Secure to wall and/or ceiling structure with appropriate hardware and fasteners, as required by wall and/or ceiling type.
- D. Coordinate with other trades, as required, to eliminate interference and obstructions with other devices.
- E. Coordinate penetrations at walls and partitions, as required. Provide fire-stop intumescent bags or other local / superseding code-approved fire-stop mechanisms at all required penetrations. Multiple fire-stop system shall be employed, as required, to equal the full capacity of the cable tray.
- F. Furnish and install the following:
 - 1. Ladder Rack: Hoffman LSS-12BLK, or approved equal, 1'-0" ladder rack system. Provide support brackets and all manufacturer-required hardware and accessories for proper mounting at each location. (Qty: as required to support pathways shown)

PART 3 - EXECUTION

3.01 INSPECTION

- A. Installer must examine substrates and conditions under which floor and wall mounted hardware and equipment enclosures are to be installed and notify the Consultant and Architect in writing of conditions detrimental to proper and timely completion of work.

3.02 INSTALLATION

- A. Install the cable management trays, floor boxes, specialty enclosures and display wall boxes at the locations shown and in accordance with manufacturer's instructions. Install all devices level, plumb, secure and at the proper height. Cooperate with other trades to secure units to finished wall and floor surfaces. Repair and replace damaged items as directed by the Architect.
- B. Coordinate layout of conduits, including specific routing and mounting elevations, with building structure and work of other trades.
- C. Avoid crossing building expansion joints, to the extent possible. Where crossings occur, use expansion joints.
- D. Provide a pull string in all raceways, cable trays, and conduits. Provide high tensile-strength pull lines in all conduits 4" and larger.
- E. Installation of wall boxes back-to-back in opposite sides of a wall shall not be allowed. Allow a minimum of 2'-0" between boxes. At stud walls, provide a minimum separation of 1 stud cavity.
- F. Provide protection for installed components so that all will be in perfect operating condition, without damage at completion of the project.

3.03 ADJUSTMENT AND CLEANING

- A. Clean exposed surfaces of installed products.
- B. Clean up all debris caused by work of this Section, keeping the premises neat and clean at all times.

END OF SECTION

**SECTION 27 1000
STRUCTURED CABLING SYSTEM (SCS)**

PART 1 - GENERAL

1.1 RELATED WORK

The following, in their entirety and as applicable, shall apply to this section. Including any associated drawings.

- A. Conditions of the Contract
- B. Division 1
- C. Division 26
- D. Division 27
- E. Division 28

1.2 DESCRIPTION

A. Summary of Work:

1. Reference Attachment 'A' of this specification for supplemental scope as it relates to the project and the Owner standards.
2. Provide a complete and tested Structured Cabling System (SCS) for the interconnections of the Local Area Network (LAN). The SCS shall include fully terminated unshielded twisted pair cables, fiber optic cabling, raceways, conduit, back boxes, copper/fiber optic termination components, station mounting hardware, fiber optic enclosures, patch panels, copper/fiber optic patch cables, relay cabinets/cabinets, and other incidental and miscellaneous premises wiring system hardware as required for a complete, tested, and usable system that is in compliance with the latest NEC, ANSI/EIA/TIA, BICSI, and Authorities Having Jurisdiction codes and standards. The installation shall comply with all applicable requirements, design guidelines, and standards in effect at the job site and as indicated in the Drawings and Specifications.
3. An IDF will be required when the distance between outlet terminations and MDF/IDF exceeds 280', including service loops. IDF's shall be selected and organized to be minimum in number while still reaching all locations to be wired.
4. If there are any discrepancies between the drawings and specification or among themselves, the contractor shall request clarification prior to providing pricing for the scope of work. If a request is not issued and a response not provided via a posted addendum, the contractor shall provide pricing for the costliest scenario and obtain clarification during the project.
5. These documents are conceptual in nature. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer's shop drawings and product data submittals shall represent a complete system and documents accepted do not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project's Technology Consultant and the Owner.

1.3 QUALITY ASSURANCE

A. Acceptable manufacturers:

1. The equipment/products described herein and furnished per these specifications shall be the product of one manufacturer or must be able to obtain the full warranty of the combined solution. All references to model numbers and other detailed descriptive data is intended to establish standards of design performance, and quality, as required. The contractor shall not deviate from the part numbers listed. Any deviation from specified part numbers will result in the removal of non-specified materials and reinstallation of approved materials at no cost to the

- project.
 2. The approved manufacturers shall provide a complete End-to-End solution with the maximum product and performance warranty offered by the specified manufacturer.
 3. Only products listed in Attachment 'B' or approved in compliance with the project manual's approval requirements will be accepted.
- B. Installer Qualifications:
1. The Data Cable System Installer shall be licensed and shall meet all applicable regulations of the State Department of Labor insofar as they apply to this type of system. The proposer shall be a firm normally employed in the low voltage and data cabling industry and shall provide a reference list of ten (10) large-scale projects and contact names confirming successful Structure Cabling System installations.
 2. The SCS Installer shall be a Certified, local area, integrator of the manufacturer's product and must be able to provide the manufacturer's maximum available warranty for the solution on the entire SCS. The contractor's certification must have been obtained and held within 75 miles of the project's location.
 3. The installing contractor must have a full-time employed RCDD (Registered Communications Distribution Designer) on staff. Current RCDD certification shall be provided in the product submittals.
 4. All individuals installing the SCS must be employees of the certified installer and at least 25% of the installing staff shall have undergone a training class given by the manufacturer. Current certification indicating the successful completion of the training course shall be available upon request at the project and submitted in the contractor's product submittals.
 5. The proposing contractor and the installing contractor must be the same company. No subcontractor to the proposing SCS contractor will be allowed for any portion of the SCS scope of work.
- C. Low Voltage Meeting Requirements:
1. The successful Contractor shall attend a mandatory pre-construction meeting with the project's consultant individuals deemed necessary by the Owner's representative prior to the start of the work. No SCS work shall begin prior to this meeting.
 2. The successful contractor shall attend a mandatory bi-weekly meeting to discuss the project progress to help aid coordination with the Owner and Other contractors.
 3. Prior to the installation of any items required for this scope of work the contractor must provide a purchase order with a detailed material list for all materials to be installed. The purchase order is not required to show cost, but part numbers must be provided. The purchase order will be reviewed during one of the regularly scheduled low voltage meetings.
- D. Acceptance: The Owner's representative reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.
- E. Warranty:
1. The selected system installer shall be a certified installing contractor of product and hold current certification. Contractor shall provide the specified manufacturer's maximum end-to-end performance warranty on all products installed. The proposer shall provide current certification documentation. The performance warranty shall be issued by the manufacturer and shall warrant that ALL cable links have been tested bi-directionally (end to end) using a Level IIIe or better tester, per TSB-67, and that all test results conform to the most current ANSI/TIA-568.2-D.
 2. The warranty will also cover multimode fiber optic cabling. Performance testing shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, method B.
 3. The warranty will stipulate that all products used in this installation meet the

prescribed mechanical and transmission specifications for such products as described in ANSI/TIA/EIA-568.3-D. Quality and workmanship evaluation shall be solely by the Owner/Designer and designated representatives.

1.4 REGULATORY REQUIREMENTS

- A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
1. Latest Local Codes and Amendments
 2. National Electrical Code, current version
- B. Other References:
1. ANSI/TIA-568-C.0 – Generic Communications Cabling for Customer Premises...
 2. ANSI/TIA-568-C.1 – Commercial Building Communications Cabling Standard Part 1: General Requirements.
 3. ANSI/TIA 568-C.2 – Balanced Twisted-Pair Telecommunications Cabling and Components Standards
 4. ANSI/TIA 568-C.3 – Optical Fiber Cabling Components Standard
 5. ANSI/TIA-568-C.4, Coaxial Cabling Component Standard
 6. ANSI/TIA-569-C – Commercial Building Standard for Telecommunications Pathways and Spaces.
 7. ANSI/TIA-492.AAAC-B – Detail Specification for 850-nm Laser-Optimized, 50-um Core Diameter/125-um Cladding Diameter Class 1a Graded-index Multimode Optical Fibers (OM3/OM4). Current Edition
 8. ANSI/ICEA S-83-596, Fiber Optic Premises Distribution Cable.
 9. ANSI/TIA/EIA-598, Color Coding of Optical Fiber Cables
 10. ANSI/ICEA S-87-640, Fiber Optic Outside Plant Distribution Cable.
 11. ANSI/TIA/EIA-758: Customer-Owned Outside Plant Telecommunications Cabling Standard.
 12. ANSI/TIA/EIA-526-7, Optical Power Loss Measurements of Installed Single mode Fiber Plant: OFSTP-7.
 13. ANSI/TIA/EIA-526-14-A, Optical Power Loss Measurements of Installed Multimode Fiber Plant: OFSTP-14A
 14. ANSI/TIA/EIA-TSB-125, Guidelines for Maintaining Optical Fiber Polarity Through Reverse-Pair Positioning
 15. ANSI/TIA/EIA-TSB-140, Additional Guidelines for Field Testing Length, Loss, and Polarity of Optical Fiber Cabling Systems.
 16. ANSI/TIA-606-B – Administration Standard for the Commercial Telecommunications Infrastructure
 17. TIA/EIA-607-B - 2011 - Commercial Building Grounding and Bonding Requirements for Telecommunications
 18. Institute of Electrical and Electronic Engineers (IEEE 802.xLAN)
 19. TIA/EIA 942 Data Center Standards
 20. Current BICSI Telecommunications Distribution Methods Manual
 21. NFPA 70 – National Electrical Code (NEC).
 22. BICSI – TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM).
- C. Governing Codes and Conflicts: If the requirements of these specifications or the Project Drawings exceed those of the governing codes and regulations, then the requirements of these specifications and the Drawings shall govern. However, nothing in the Drawings or Specifications shall be construed to permit work not conforming to all governing codes, regulations, and manufacturer installation requirements.

1.5 ABBREVIATIONS

- A. The following abbreviations are used in this document:
- IDF Intermediate Distribution Frame

MDF	Main Distribution Frame
UTP	Unshielded Twisted Pair
SCS	Structured Cabling System
RCDD	Registered Communications Distribution Designer

1.6 SUBMITTALS

- A. Project Initiation: Within fourteen (14) days of Notice to Proceed, the data network system installer shall furnish the following in a single consolidated submittal:
1. Permits: The Contractor shall obtain all required permits and provide copies to the Owner / Architect / Engineer.
 2. Product Literature: Complete manufacturer's product literature for all cable, patch panels, cross-connect blocks, cable supports, cable labels, outlet devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner / Designer) and the manufacturer's supporting documentation demonstrating compatibility with other related products shall be included. The submittal shall have some type of distinguishing marker or pointer to indicated what specific product is to be provided
 3. Construction Schedule: A time-scaled Construction Schedule, using PERT/CPM, indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
 4. Testing: Proposed Contractor UTP cable test result forms, fiber optic cable test result forms and a list of instrumentation to be used for systems testing.
 5. Specification Compliance: A letter shall be provided stating, by section and subsection, that the SCS installer complies with the entire specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the Owner.
 6. Each Submittal must have a detailed parts list with quantities.
 7. Certifications: The contractor shall submit all certifications for approved products and the certifications must contain dates which are valid from the date of proposal and not expires any sooner than 12 months after substantial completion of the project.
 - a. BICSI RCDD Certification: This certification must be held by an on-staff, full-time employee of the SCS installer. The holder must be staffed out of the office that is located within 75 miles of the projected.
 - b. Certifications must be obtained by the SCS installer's office that is located within 75 miles of the project and shall be a company certification, not an individual certification.
 - c. Certifications must be held by at least 25% of the, on-site, staff and be made available at the site if requested by the owner, architect, and/or project's technology consultant.
 - d. Fiber Optic Technician Certification: This certification must be held by the on-staff/on-site individual that is supervising the fiber optic installation and performing the fiber optic terminations and testing.
- B. Shop Drawings: Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
1. Proposed circuit routing and circuit grouping plan prepared by a BICSI certified RCDD (Registered Communications Distribution Designer). The RCDD certification must be current. Identifiable, separate routing shall be shown for both the station cabling and the MDF-to-IDF tie cabling.
 2. In addition to the cable routing, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general

- contractor:
- a. Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)
 - b. Location of sleeved wall pass-thru
 - c. Size of sleeve at each location installed
 - d. Quantity of cable passing through each sleeve
 - e. Location of drops in each room (quantity or labeling of drops are not required in the submittal plans. Labeling shall be provided in the closeout plans and quantities shall be as per the contract documents, addendums, and issued changes. Each drop shall be labeled for the type of outlet that it is)
 - f. Conduit routing, size, quantity, and stub-up locations for all floor mounted outlets.
3. Drawing Compliance: A letter shall be provided stating that the SCS installer complies with the entire project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the Owner.
 4. All subcontractors shall provide submittals to general contractor for normal distribution to Architects, Engineers and the Owner's project managers.
- C. At Substantial Completion: Provide drawings, to the Owner, to reflect installed cabling with correct labeling and cable routing.
- D. Close-out Procedures: Two (2) copies of the following documents shall be delivered to the building owner's representative at the time of system acceptance. Close out technology documents shall be separated from all other trade's documents. The close out finals shall include:
1. Inspection and Test Reports: During the course of the Project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed, conform to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
 2. Provide complete test reports for all cabling and devices that comprise system as outlined in this document.
 3. Include the Name, address and telephone of the authorized factory representative with a 24-hour emergency service number.
 4. The manual shall also include Manufacturer's data sheets and installation manuals/instructions for all equipment installed a list of recommended spare parts.
 5. Generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement.
 6. An up-to-date record ("as-built") set of approved shop drawing prints that have been revised to show each and every change made to the structure cabling system from the original approved shop drawings. Drawings shall consist of a scaled plan of each building showing the placement of each individual item of the technical cabling system equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway.
 7. As-built Drawings shall include cable pathways, camera locations with correct labeling and MDF/IDF locations. A copy of the As-Built drawings reflecting the final locations of all cabling shall be given to the designated Owner's representative. The as-built drawings shall be prepared using AutoCAD 2012 or later. Provide the Owner with electronic versions of the as-builts on CD media.
 8. All drawings must reflect final graphic numbering, point to point wiring, device

address and programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system.

9. A copy of the manufacturer's warranty on the installed system.
10. Any keys to cabinets and/or equipment and special maintenance tools required to repair, maintain, or service the system.
11. Operating and Maintenance Instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction, and shall be provided to the Owner, for their use, in a three-ring binder labeled with the project name and description. (4 copies)
12. Upon completion of the work and at a time designated by the Architect or owner, provide formal training sessions for the Owner's operating personnel to include location, operation, and maintenance of all included systems and equipment. Minimum amount of training time shall be at least 4 hours.
13. One (1) 30" x 42" laminated floor plan sheets illustrating technology drops and cable designation with final graphic numbering. Contractor shall provide one complete floor plan sheet for each telecommunications room (MDF or IDF)

PART 2 - PRODUCTS

2.1 GENERAL

- A. Reference Attachment 'B' to this specification, which contains the minimum materials list for this specific project.
- B. Installation: The cabling shall be installed per requirements of the manufacturer and the Project Documents utilizing materials meeting all applicable TIA/EIA standards. The Contractor is responsible for providing all incidental and/or miscellaneous hardware not explicitly specified below as required for a complete and operational system.
- C. Materials shall be as listed or shall be approved equivalent products of other manufacturers meeting the intent and quality level of the TIA/EIA specifications.
- D. Testing: All installed cabling shall be tested 100% good after installation by the Contractor. All final test results shall be delivered to owner at completion of project. Refer to closeout requirements.
- E. Ratings: All products shall be new and brought to the job site in the original manufacturer's packaging. Electrical components (including innerduct) shall bear the Underwriter's Laboratories label. All communications cable shall bear flammability testing ratings as follows:
 - CM Communications Cable
 - CMP Plenum Rated Communications Cable
 - CMR Riser-Rated Communications Cable
- F. Initial Cable Inspection: The Contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of the proper gauge, containing the correct number of pairs, etc. Note any buckling of the jacket that would indicate possible problems. Damaged cable or any other components failing to meet specifications shall not be used in the installation.
- G. Cable Lubricants:
 1. Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit.
 2. Approved Products
 - a. Twisted-pair cable: Dyna-Blue
 - b. American Polywater
- H. Fire Wall Sealant:
 1. Any penetration through firewalls (including those in sleeves) will be resealed with an Underwriter Laboratories (UL) approved sealant.
 2. Approved Products
 - a. 3M or

b. Pre-approved equal

2.2 DATA CLOSET (MDF/IDF) HARDWARE

- A. Equipment Cabinets/Cabinets: Provide and install equipment cabinets and/or cabinets in locations indicated on the attached drawings for the following areas.
1. For all MDF/IDF locations: Contractor shall provide and install a new floor mounted cabinet/rack system or a wall mounted cabinet where indicated on plans. Refer to floor plan and enlarged MDF/IDF room layouts for number of cabinets/racks to provide at each location. If an enlarged detail is not available, the contractor shall provide the required number of racks to accommodate 100% of all termination components and an equal amount of owner equipment; as well as (1) spare rack. If an MDF/IDF is located in shared space, the contractor shall provide a floor supported, wall mounted cabinet system with all required doors and side panels to secure the equipment and termination components.
- B. Distribution Cabinet/Cabinet Grounding: All Cabinets and/or Cabinets shall be grounded using stranded #6 AWG insulated copper conductor. Connect to service entrance grounding electrode. Provide all required bonding materials and hardware and bond to building grounding electrode subsystem at building electrical service entrance.
- C. Fiber Optic Patch Panels:
1. The enclosures used shall provide termination panels for the specified type of connectors and be of sufficient size and capacity to terminate 110% of the fiber count of the inside of outside fiber optic cables. Patch panels must be 19" cabinet mountable. Provide all termination accessories, fiber patch cords, enclosures and test for a complete fiber optic distribution system.
 2. Provide closet connector housing panels, size for 110% of total fiber count to be terminated.
 3. ALL fiber strands must be terminated in fiber housing.
- D. Patch Panels:
1. All patch cables shall be modular type patch panels to allow individual jacks to be inserted. All patch panels shall be fully populated with Jacks. Provide dust caps for all unused jacks. Furnish units that adhere to the performance requirements TIA/EIA-568A standards.
 2. Provide cable support bars at the back of all patch panels to provide additional support at rear of panels. Provide one (1) support bar for each row of 24-ports. Support bars will not be required if the closet design consist of rear horizontal cable management above and below each patch panel.
- E. Rack Electrical:
1. A power strip shall be installed vertical at the back of each data relay rack.
 2. Project electrical contractor to provide and install one electrical receptacle for each UPS installed on the entire project. Coordinate receptacle type and location with the installed product requirements and the technology consultant prior to installation.
- F. Cable Management Panels:
1. Provide cable management panels as required for vertical cable management on ends and in between all racks on entire project.
 2. Provide Velcro straps for cable dressing in MDF/IDF rooms.
- G. MDF/IDF Patch Cables:
1. Cabling Contractor shall provide owner with one (1) patch cable for each data drop on entire project. These cables will provide connectivity from the front of the network patch panels to the network equipment. The patch cables are to be terminated properly with RJ-45 connections on each end with the proper pin-out assignments per project configuration.
 2. All patch cables shall be factory terminated. NO EXCEPTIONS.

2.3 CABLE ROUTING/PATHWAY

- A. Cable Tray:
 - 1. Metal cable tray shall be provided to affix to the top of all floor mount cabinets. Cable tray shall be used to brace cabinets to walls and to route cable from walls to cabinets in communication closets.
 - 2. Contractor to provide and install all applicable installation accessories.
- B. Cable Support System:
 - 1. All low voltage cabling shall be installed and supported using an approved cable support system installed at 48" intervals unless installed in conduit. Do not exceed manufacturer's recommendation for the quantity of cables supported in an individual support.
 - 2. Cable supports shall not connect to any ceiling grid wire or on any support attached to the ceiling grid.
 - 3. Cable supports shall not exceed a serviceable height of more than 5', but no closer than 2', above the finished ceiling.
 - 4. Cable supports can be attached to vertical walls or the building's structure.
 - 5. If attached to the building's structure, 3/8" threaded rod shall be utilized to extend down within the serviceable heights mentioned above. Grid wire hangers will not be accepted.
- C. All cable bundles shall be grouped together using plenum rated Velcro for the entire run above and below the ceilings.
- D. Conduit Bushings shall be installed prior to the installation of any cable. If cable is found to be installed without the bushing the cable will have to be removed and re-installed. No cut bushings will be accepted. If cable damage occurs during any portion of the installation, the cable will be removed and replaced at no cost to the project. This item will be strictly enforced and adhered too.
- E. The projects electrical contractor shall provide and install all metallic conduit and backboxes indicated to be installed on the drawings. It is the SCS installer's responsibility to coordinate all conduit requirements with the electrical contractor to ensure that all conduit sizes and locations are correctly installed. If box locations and conduit sizes are found to vary from the project documents after installation the SCS installer will bare all financial responsibility to ensure these items are installed correctly. The RCDD for the SCS will be responsible for ensuring conduit sizes are sufficient for cable count while maintaining a 40% fill ratio. If there is not electrical contractor on the project, the SCS Installer shall bear responsibility for the provision and installation of all required raceways.

2.4 STATION WIRING

- A. Wire: The data and voice wire provided for all outlets shall be four-pair, solid copper conductor, meeting the intent and quality level of the TIA/EIA-568 Commercial Building Wiring Standard.
- B. Testing: The four-pair UTP cable must be UL Performance Level tested. Each 1000-foot spool must be individually tested with test results affixed to the spool. All cable must be provided on new 1000-foot spools. No shorts will be allowed.
- C. Rating: Cable installed in conduit shall be non-plenum rated. Cable not installed in conduit shall be plenum rated if installed in plenum ceiling space, non-plenum rated otherwise.
- D. All cable shall be routed to the center of the room in which it is serving and then route to the outlet location that it is intended for. Provide a 5' service loop in the center of the room and 5' service loop at each workstation outlet properly supported above ceiling. All workstation service loops shall be made in figure eight configurations, no exceptions.
- E. Provide minimum of 10' service loop at all headend locations properly supported above ceiling.
- F. Provide indoor/outdoor, plenum rated category cable at any outdoor data outlet or data outlets served by cabling that travels through subsurface conduit. This applies to station or horizontal cable runs only.

2.5 STATION HARDWARE

- A. Information Outlet / Jack Modules:
 - 1. Shall be high quality 8p/8c modular jacks with circuit board construction and IDC style or 110-style wire, T568B terminations. Jacks shall meet EIA/TIA TSB40 recommendations for connecting hardware
 - 2. Shall be standard 8-position, RJ-45 Style, FCC compliant
 - 3. Shall be designed for 4-pair, 100 Ohm balanced UTP Cable
 - 4. Shall terminate 26-22 AWG solid or stranded conductors
 - 5. Shall accept FCC compliant 6 position plugs.
 - 6. Shall have attached wiring instruction labels to permit either T568A or T568B wiring configurations.
 - 8. Shall meet or exceed transmission requirements for connecting hardware, as specified in ANSI/TIA/EIA-568-C2, Transmission Performance Specifications for 4-Pair 100 Ohm.
 - 9. Shall be UL Listed and CSA certified.
 - 10. Each jack shall have category rating identified on the front face.
- B. Faceplates:
 - 1. Standard faceplates shall be a minimum of 4-port.
 - 2. Wall mounted telephone faceplates shall be 1-port.
 - 3. All faceplates shall be single gang.
 - 4. All blank inserts color shall be coordinated prior to procurement.
- C. Outlet Patch Cables: Cabling Contractor shall provide owner with patch cable for each data drop on entire project. Each cable will be terminated properly with RJ45 connections on each end with appropriate pin-out assignments per project configuration.
 - 1. Cabling Contractor shall provide owner with patch cable for each data drop on entire project. Each cable will be terminated properly with RJ45 connections on each end with appropriate pin-out assignments per project configuration.
 - 2. Patch cords shall be stranded copper, matching the category of the installed cable.
 - 3. All patch cables shall be factory terminated. No exceptions

2.6 FIBER OPTIC PRODUCTS

- A. Multimode: 50/125um, OM4+, multimode fibers, each with a color-coded PVC tight buffer shall have a maximum attenuation of 3.5 dB/km at 850 nm and 1.5 dB/km at 1300 nm. Minimum bandwidth shall be 2000 MHz/km at 850 nm and 500 MHz/km at 1300 nm.
- B. Singlemode: Single mode fibers, each with a color-coded PVC tight buffer shall have a maximum attenuation of 1.0 dB/km at 1310 nm and 1.0 dB/km at 1550 nm.

PART 3 - EXECUTION

3.1 GENERAL

- A. Fire Wall Penetrations: The contractor shall avoid penetration of fire-rated walls and floors wherever possible. Where penetrations are necessary, they shall be sleeved with metallic conduit and resealed with an Underwriter Laboratories (UL) approved sealant. Contractor shall also seal all floor, ceiling and wall penetrations in fire or smoke barriers and in the wiring closet.
- B. Allowable Cable Bend Radius and Pull Tension: In general, communications cable cannot tolerate sharp bends or excessive pull tension during installation. Refer to the cable manufacturers allowable bend radius and pull tension data for the maximum allowable limits.
- C. Cable Lubricants: After installation, exposed cable and other surfaces must be cleaned free of lubricant residue.
- D. Pull Strings: Provide pull strings in all new conduits, including all conduits with cable installed as part of this contract. Pull test is not to exceed 200 pounds. Data and video cables can be pulled together with pull strings.

- E. Conduit fill shall not exceed 40%.
- F. Damage:
 - 1. The Contractor shall replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over-tightened bindings, loosely twisted and over-twisted pairs at terminals and cable sheath removed too far (over 1-1/2 inches).
 - 2. The Contractor shall replace any damaged ceiling tiles that are broken during cable installation.
- G. Clean Up: All clean up activity related to work performed will be the responsibility of the Contractor and must be completed daily before leaving the facility.
- H. Conduit and Back Boxes:
 - 1. The Contractor shall ensure that the appropriate back boxes and conduits, for the project, are provided as required.
 - 2. One (1) 1" conduit will be required each outlet that serves one to a maximum six (6) category 6 or a maximum of four (4) category 6A cables. Provide additional conduit for cable counts that exceed this number.
 - 3. One (1) double gang deep box will be required for each technology outlet. All boxes except Presentation outlets will be required to have a single gang reducer ring.

3.2 EQUIPMENT CABINET CONFIGURATION

- A. Equipment Cabinets: Equipment racks shall be assembled and mounted in locations shown on the Drawings and as detailed. Each rack shall be securely mounted to the floor and braced to the wall with cable tray in accordance with the manufacturer's instructions and recommendations. Racks shall be mounted such that the side rails are plumb with vertical cable management panels. Racks to be located such that future expansion can occur without relocating existing racks. Racks shall be grounded in accordance with NEC requirements.
- B. Wire Management Components: Horizontal cable management panels shall be installed directly above and below each patch panel. Vertical cable management panels shall be installed on each side of the cabinet.
- C. Cable Placement: Cable installation in the Wiring Closet must conform to the Project Drawings. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance location. Avoid crossing area horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining a working distance from these openings.
- D. Cable Routing: Cable shall be routed as close as possible to the ceiling, floor or corners to ensure that adequate wall or backboard space is available for current and future equipment. All cable runs within the Wiring Closet shall be horizontal or vertical within the constraints of minimum cable bending radii. Minimum bend radius shall be observed. Cables shall not be tie-wrapped to electrical conduit or other equipment.
- E. Installation: All incoming cables shall be routed on the cable tray and neatly dressed down to the patch panels. Cable bundles shall not exceed more than 48 cables to patch panel.
- F. Hardware: Provide cabinet and jack panel hardware as required for all data station wiring.

3.3 STATION WIRING INSTALLATION

- A. General:
 - 1. Cabling between wiring closet and workstation locations shall be made as individual home runs. No intermediate punch down blocks or splices may be installed or utilized between the wiring closet and the communications outlet at the workstation location.
 - 2. All cable must be handled with care during installation so as not to change performance specifications. Factory twists of each individual pair must be maintained up to the connection points at both ends of the cable. There shall never

- be more than one and one-half inches of unsheathed UTP cable at either the wiring closet or the workstation termination locations.
3. All cable shall be routed to the center of the room in which it serves before routing to the outlet location and a 5' service loop shall be provide. An addition 5' service loop shall be provided above ceiling at the outlet location. All service loops shall be figure 8 loops.
- B. Exposed Cable:
1. All cabling shall be installed inside walls or ceiling spaces whenever possible. Exposed cables and/or cables routing through mechanical rooms, electrical rooms, or restrooms shall be installed inside conduits, unless noted otherwise on the project drawings.
 2. Additional exposed cable runs will require Owner approval and will only be allowed when no other options exist.
 3. All cable routing through conduits and sleeves shall maintain a 40% maximum conduit fill ratio.
- C. Placement: All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the Owner's efficient use of their full capacity.
- D. Cable Routes:
1. All cabling placed in ceiling areas must be in conduit, or Panduit Corp. J-MOD modular cable support with Velcro cable wrap at each location. Cable supports shall be permanently anchored to building structure or substrates. Provide attachment hardware and anchors designed for the structure to which attached and that are suitably sized to carry the weight of the cables to be supported. Do not route cable through webbing of structural steel. Cabling must be supported in dedicated supports intended to support cabling as described in this section. Contractor shall adhere to the manufacturer's suggested fill ratio for each size cable support installed. No support shall have more than 48 cables.
 2. Attaching cable to pipes or other mechanical items is not permitted. Communications cable shall be rerouted so as to provide a minimum of 18 inches spacing from light fixtures, sources of heat, power feeder conduits and EMI sources. Cabling shall not be attached to ceiling grid support wires. Cable runs shall be routed down the corridors; parallel or perpendicular to building structure. Multiple cables to be bundled together at and between each cable support installed.
 3. Contractor shall be responsible for coordinating with other trades on the project so that the installed cable pathway does not interfere with the installation of other systems to ensure that mechanical ducts, pipes, conduits, or any other above ceiling systems are not putting unnecessary stress on any portion of the install SCS.
 4. All (48) cable bundles shall be routed directly to the MDF or IDF that serves the area. All bundles shall remain separated for the length of the cable run.
 - a. Provide data outlet for irrigation controllers. Coordinate location with landscape consultant.
 - b. Provide data outlet for time clock appliance in main custodian office.
 - c. Provide OSP or flooded/gel filled cat6 cable at any outdoor data outlet or data outlets served by cabling that travels through subsurface conduit. This applies to station or horizontal cable runs only.

3.4 STATION HARDWARE

- A. Flush Mount Jacks shall be mounted in a faceplate with back box.
- B. Placement:
1. Where possible, the communications outlet shall be located so that its centerline is 18 inches above floor level or 12 inches above permanent bench surfaces.

- Outlets shall not be mounted on temporary, movable, or removable surfaces, doors, or access hatches.
2. Outlets shall be installed within 3'-0" of power outlets
- C. RJ-45 Jack Pin Assignments:
1. Pin connections for data station cable outlets and patch panels shall match EIA/TIA 568 modular jack wiring recommendation T568B.
 2. Pin connections at data jack panels shall match pin connections at outlets (straight through wiring)

3.5 CABLE TESTING REQUIREMENTS

- A. Notification: The Owner and Engineer shall be notified one week prior to any testing so that the testing may be witnessed.
- B. Inspection: Before requesting a final inspection, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms and timetable for all copper and fiber optic cabling.
- C. Procedures:
1. Trained personnel shall perform all testing. Acceptance of the test procedures discussed below is predicated on the Contractor's use of the recommended products and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation will be evaluated in the context of each of these factors.
 2. Acceptance shall be subject to completion of all work, successful post-installation testing which yields 100% PASS rating, and submittal and approval of full documentation as described above. Tests with the "*" PASS" (asterisk) will not be acceptable. These circuits must be repaired to meet "PASS".
- D. Errors: When errors are found, the source of each shall be determined, corrected and the cable retested. All defective components shall be replaced and retested. Re-test results must be provided on Owner approved forms and witnessed by Owner.
- E. Twisted Pair Cable Testing:
1. At a minimum, the Contractor shall test all station drop cable pairs from Data Closet termination patch panels to outlet device RJ45 jacks. Products shall be tested for compliance with ANSI/TIA/EIA 568A and ISO/IES 11801. Test equipment used shall meet TIA/EIA TSB-67, Level II accuracy. Further, the contractor shall have a copy of TSB-67 in their possession and be familiar with its contents.
 2. Each wire/pair shall be tested at both ends for the following:
 - a. Wire map (pin to pin connectivity)
 - b. Length (in feet)
 - c. Attenuation
 - d. Near end cross talk (NEXT)
 - e. Power Sum
 3. Test equipment shall provide an electronic and printed record of these tests.
 4. Test results for each four-pair UTP cable must be submitted with identification to match labels on all patch panel ports and RJ45 jacks and must match as-builts associated with that cable.
- F. Fiber Optic Cable Testing:
1. Testing device for fiber optic cables shall be a high quality OTDR (Optical Time-Domain Reflectometer) equipped with a printer. The printed data shall show, in addition to any summary information, the complete test t0.and all relevant scale settings. The OTDR must have the capability to take measurements from bare fiber strands as well as SC connector terminations.
 2. All fiber optic cable shall be tested on the reel before installation to ensure that it meets the specifications outlined herein.
 3. After installation the Contractor shall test each fiber strand in accordance the EIA

455-171 Method D procedures (bi-directional testing) at both 850nm and 1300nm for multimode or 1310nm and 1550nm for single mode. A form shall be completed for each cable showing data recorded for each strand including length, total segment (end-to-end) loss (dB) and connector losses (dB) at each end. In addition, the printed data strip for each strand shall be attached to the form. Patch cables shall also be tested.

4. Acceptable fiber optic connector loss shall not exceed .75dB per mated pair. The Contractor is responsible for obtaining minimum loss in fiber connections and polishing per manufacturer specifications.
5. Singlemode fibers shall have a maximum attenuation of 1.0 dB/km at 1310 nm and 1.0 dB/km at 1550 nm.
6. Multimode: 50/125um micron multimode fibers shall have a maximum attenuation of 3.5 dB/km at 850 nm and 1.5 dB/km at 1300 nm. Minimum bandwidth shall be 2000 MHz/km at 850 nm and 500 MHz/km at 1300 nm.

3.6 INSPECTION

- A. Conformance to the installation practices covered above is to be verified when completed. In some cases, the Owner/Designer may inspect before acceptance.
 1. Written Test Report:
 - a. Complete test results, including actual values associated with tests.
 - b. Show all certifications for telecommunications wiring systems.
 - c. Include cable maps showing each cable route and keyed to cable labels. Provide owner with complete floor plans identifying outlet location and cable routing drawing in AutoCAD format. Provide electronic copy of drawings to owner in AutoCAD version 2012 or greater.
 - d. Documentation of outlet, cable and cabinet labeling system.
- B. After performing all tests, tabulate results and bind together in format acceptable to Owner. Installer shall provide written certification in the test report that telecommunications cable is properly installed, and test results certify system to all specified standards.

ATTACHMENT 'A'
PROJECT SPECIFIC SCOPE OF WORK AND INSTRUCTIONS

PART 1 – SUMMARY OF WORK

1.1 DESCRIPTION OF WORK

- A. This project consists of the provision and installation of a Structured Cabling System (SCS) as required to support network connectivity to workstations, telephones, video surveillance, access control, building automation, electrical lighting, and any other system requiring network connectivity. This project is a renovation and addition to Cy Ranch HS and is the expansion of the existing system.
- B. The work includes provision and installation of a complete Cabling System (SCS) in compliance with these specifications and associated drawings, pre-proposal addenda, change orders, change directives and any other documents issued both pre-proposal and during the project.
- C. The SCS Installer shall comply with all conditions of the contract and "Division 1 – General Requirements" as they apply to the SCS Scope of Work. It shall be the responsibility of the SCS Contractor to make themselves familiar with all documents.
- D. It should not be assumed that any portions of a complete and functional system are to be furnished and/or provided by anyone, other than the SCS installer, unless specifically stated otherwise.
- E. Division of responsibilities:
 - OFOI = OWNER FURNISHED AND OWNER INSTALLED
 - CFCI = CONTRACTOR FURNISHED AND CONTRACTOR INSTALLED
 - 1. CATEGORY 6A CABLING – OFOI
 - 2. MDF/IDF NETWORK EQUIPMENT – OFOI
 - 3. VOIP TELEPHONES – OFOI
 - 4. WIRELESS ACCESS POINTS – OFOI
 - 5. UNINTERRUPTIBLE POWER SUPPLIES – OFOI
 - 6. RACEWAY: CONDUIT, BACK BOXES, SLEEVES, ETC – CFCI

1.2 STRUCTURED CABLING SYSTEM – ADDITIONAL INSTRUCTIONS

- A. Base Proposal:
 - 1. The SCS Installer shall provide and install a Commscope/Systemax End-to-End Structured Cabling System as per these specifications and associated drawings. The Base bid SCS shall consist of:
 - a. Category 6A cable and connectivity to each Video Surveillance Camera, Voice/Data Outlet, Access Controlled Door, and any other locations requiring Local Area Network Connectivity.
 - b. Category 6A cable and connectivity to each Wireless Access Points.
 - c. Each connectivity solution be a complete Channel Solution; consisting of jacks, patch panel, and patch cables.
 - d. Each channel solution shall be color coded to the system in which it serves.
 - 2. The products specified in Attachment 'B' are intended to establish quality, functionality, color, and standards. The following shall be considered preapproved equivalent for each specific portion of the SCS.
 - a. Category 6A copper cable
 - 1) Commscope/Systemax
 - b. Category 6A copper cabling, termination components, and patch cables
 - 1) Commscope/Systemax
 - c. Fiber Optic Cabling and Components:
 - 1) Commscope
 - d. Metals (racks, cable managers, and cable tray):
 - 1) Commscope

- e. Manufacturer approval request must be submitted in compliance with the Division 1 instructions and must be received no less than ten (10) business days prior to the posted proposal submission date. No substitutions will be allowed if not submitted per these instructions and approved via official pre-bid addendum.

1.3 COPPER PATCH PANELS

- A. The SCS Installer shall provide and install patch panels as per the instructions below.
 - 1. 24-port patch panels shall only be used for copper tie cables and demarcation extensions.
 - 2. Provide dedicated, 48-port patch panels for each of the following system (reference color code chart for designated insert and patch panel color coding per system):
 - a. LAN and IP Telephones
 - b. Wireless Access Points
 - c. IP Intercom
 - d. Video Surveillance Cameras

1.4 COPPER AND FIBER OPTIC PATCH CABLE LENGTHS

- A. The SCS Installer shall provide copper and fiber optic patch cables as per the instructions below. All patch cables shall be factory terminated and warranted for the copper and fiber solutions specified.
 - 1. MDF/IDF Copper Patch Cables:
 - a. Patch cables shall be category 6A
 - b. Provide one patch cable for each port on the entire project
 - c. Patch cables to be installed by network equipment installer/programmer
 - d. Patch cable lengths
 - 1) 95% shall be 5'
 - 2) 5% shall be 7'
 - 2. Work Area Outlet Copper Patch Cables:
 - a. Patch cables shall be category 6A
 - b. Provide one patch cable for each port on the entire project
 - c. Patch cables to be installed by the owner.
 - d. Patch cable lengths
 - 1) 90% shall be 10'
 - 2) 10% shall be 15'
 - 3. Wireless Access Point Copper Patch Cables:
 - a. Patch cables shall be category 6A
 - b. Provide one patch cable for each port on the entire project
 - c. Patch cables to be installed by wireless system installer.
 - d. Patch cable lengths
 - 1) Interior Ceiling Access Points: 100% shall be 1.5'
 - 2) Interior Wall Mounted Access Points: 100% 1'
 - 3) Exterior Access Points: 100% shall be 15'
 - 4. Video Surveillance Camera Copper Patch Cables:
 - a. Patch cables shall be category 6A
 - b. Provide one patch cable for each port on the entire project
 - c. Patch cables to be installed by the Video Surveillance System Installer.
 - d. Patch cable lengths
 - 1) Interior Ceiling Cameras: 100% shall be 1.5'
 - 2) Interior Wall Mounted Cameras: 100% 3'
 - 3) Exterior Cameras: 100% shall be 15'
 - 5. IP Intercom Copper Patch Cables:
 - a. Patch cables shall be category 6A

- b. Provide one patch cable for each IP Intercom device on the entire project, plus an additional twenty (20) for future use.
- c. Patch cables to be installed by the IP Intercom System Installer.
- d. Patch cable lengths
 - 1) Interior Ceiling Speakers: 100% shall be 1.5'
 - 2) Interior Wall Mounted Speakers: 100% 1'
 - 3) Exterior Speakers: 100% shall be 15'
- 6. MDF/IDF Fiber Optic Patch Cables:
 - a. Patch cables shall be OS2 (Single-mode).
 - b. Patch cable shall be duplex, LC to LC
 - c. Provide quantity sufficient for connecting all network equipment plus 20% for growth.
 - d. Patch cables to be installed by network equipment installer/programmer
 - e. Patch cable lengths
 - 1) 100% shall be 3 meters
- 7. Prior to submittal and procurement of fiber optic and copper patch cables, the contractor shall coordinate with the project Consultant and Owner of final requirement for cable lengths on the specific project.

1.5 SYSTEM SPECIFIC COLOR REQUIREMENTS

- A. The following information shall apply to the complete SCS Channel. All cable, patch cables, outlet terminations, and closet terminations shall be provided in the colors designated below:

Item	Description	Horizontal Cable	Insert	Patch Cables
1	Data	Blue	Blue	Blue
2	VoIP Telephone	Blue	Blue	Blue
3	Wireless	Orange	Orange	Orange
4	Camera	Lilac	Lilac	Lilac
5	Access Control	Lilac	Lilac	Lilac
6	Intrusion Detection	Lilac	Lilac	Lilac
7	PA System	White	White	White

1.6 DOCUMENTATION

- A. Labels: The Contractor will label all outlets using permanent / legible typed or machine engraved labels approved by the Owner (no handwritten labels permitted). Label patch panels in the wiring closet to match those on the corresponding data outlets. The font shall be at least one-eighth inch (1/8") in height, block. All labels shall correspond to as-builts and to final test reports.

- 1. The following nomenclature shall be used when labeling data/voice jacks:
 - a. All cables being served by MDF closet shall begin with 'A' all IDF served cables shall begin with numerical digit 'B' thru 'Z') designating the specific IDF's identification.
 - b. Next identification character shall be a numeric digit identifying the specific patch panel that is serving outlet (1, 2, 3...)
 - c. Next identification shall note what # data port on patch panel (01 thru 48).

Example:

Label of an outlet from 23rd port of the third patch panel from top of rack located at IDF-2 shall read: C-3-23

Label of an outlet from the 5th port of the second patch panel from the top of rack located

- in the MDF shall read: A-2-05
- B. Floor Plan: A floor plan clearly labeled with all outlet jack numbers shall be included in the as-built plans.
 - C. Cables: All cables shall be labeled at both ends. This includes but not limited to horizontal voice and data cabling, copper backbone tie cables, and fiber optic cables.
 - D. Fiber Optics: Fiber optic strands shall be labeled at both ends on the fiber distribution panel.
 - E. Equipment racks: Equipment racks shall bear at least one indicating label indicated MDF or IDF. If rack is installed in IDF, label shall include IDF #.
 - F. Access Points: Label ceiling grid with digital label according to location installed and a bright orange $\frac{3}{4}$ " round dot sticker.

ATTACHMENT 'B'
MANUFACTURER AND MATERIAL LIST

The Communications Contractor shall perform no portion of the work requiring submittal and review of record drawings, shop drawings, product data, or samples until the respective documentation has been approved by project's Technology Consultant.

COMMSCOPE PRODUCT LIST:

1.1

2-Post, 7-ft equipment Rack	760082479	RK3-45A
6" Single Sided Vertical Cable Manager Black	760244792	VCM-SS-84-6B
8" Single Sided Vertical Cable Manager Black	760244792	VCM-SS-84-8B
2U Horizontal Cable Manager Double Sided	760128850	HTK-19-DS-2U
Straight Cable Runway- 10', 12" Wide	760085647	CR-SLR-10L12W
Cable Runway to Rack Mounting Kit	760084053	CRR2RRMK
Cable Runway Butt Splice Kit	760083899	CRBSK
Cable Runway Joint Splice Kit	760084046	CRTJSK
Triangular Runway Wall Support Bracket Kit 12"	760084095	CRTWSBK-12
Cable Runway Wall Rail Support Kit 6"-12"	760084145	CR6-12WRSK
Cable Runway Vertical Wall Bracket	760084137	CRVWBK
Cable Runway Rung Drop Out 12"	760083956	CRDK-12W
Cable Runway Ceiling Mount Kit 3/8" Threaded Rod	760083907	CRCMK3-8TR
Cable Runway Protective End Cap Kit	760084012	CRPECK
CPI Elevation Kit	10506-706	

1.2

Category 6A Blue Plenum	760107291	2091B Blue C6A 4/23 W1000
Category 6A Purple Plenum	760107235	2091B Purple C6A 4/23 W1000
Category 6A Orange Plenum	760107227	2091B Orange C6A 4/23 W1000
Category 6A White Plenum	760107268	2091B White C6A 4/23 W1000
24 Port 1U High Density Modular Panel	760118323	M2400-1U-GS
48 Port 1U High Density Modular Panel	760105429	M4800-1U-GS
Category 6A Blue Outlet	760092452	MGS600-BL
Category 6A Violet Outlet	760092460	MGS600-VI
Category 6A Orange Outlet	760092379	MGS600-OR
Category 6A Green Outlet	760092429	MGS600-GN
2 Port Stainless Steel Faceplate	760072181	M12SP-L
4 Port Stainless Steel Faceplate	760072207	M14SP-L
CCA-Cat6A-Plenum	760235592	
1 Port Surface Mount Box- White	760248521	SMB-1P-262
Dust Covers for Faceplate/Panel Blanks (100 gray)	107067951	M20AP-270

1.3

Category 5E 25-Pair Plenum	2061B Cat5e U/UTP WHT 25/24 R1000 or R4000
12 Fiber Singlemode Armored Plenum	760127803 P-012-DZ-8W-FSUYL
1U Sliding Fiber Panel	760209940 HD-1U
2U Sliding Fiber Panel	760209957 HD-2U
4U Sliding Fiber Panel	760209965 HD-4U
Singlemode 12 Fiber Splice Cassette (w pigtails)	760245401 G2-SP-12LCG-PT
Singlemode 24 Fiber Splice Cassette (w pigtails)	760244929 G2-SP-24LCG-PT
Wall Mount Fiber Panel	760244929 WB2-EMT-BK-1P-PNL

1.4

12 Fiber, OSP, Gel Free, Armored, SM Apparatus Above	760053280 D-012-LA-8W-F12NS
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1.5		
1' Category 6A Blue Patch Cord		CPCSSX2-0ZF001
1' Category 6A White Patch Cord		CPCSSX2-08F001
1' Category 6A Lilac Patch Cord		CPCSSX2-0BF001
1' Category 6A Orange Patch Cord		CPCSSX2-06F001
15' Category 6A Blue Patch Cord		CPCSSX2-0ZF015
15' Category 6A White Patch Cord		CPCSSX2-08F015
15' Category 6A Lilac Patch Cord		CPCSSX2-0BF015
15' Category 6A Orange Patch Cord		CPCSSX2-06F015
15' Category 6A Blue Plenum Patch Cord		CPCSSY2-0ZF015
15' Category 6A White Plenum Patch Cord		CPCSSY2-08F015
15' Category 6A Lilac Plenum Patch Cord		CPCSSY2-0BF015
15' Category 6A Orange Plenum Patch Cord		CPCSSY2-06F015
1.6		
2 meter Duplex Singlemode Patch Cords		FEWLCLC42-JXM002
2 meter Duplex Singlemode Uniboot Patch Cord		FDWLCLC42-JXM002
7' Duplex Singlemode Patch Cords		FEWLCLC42-JXF007
7' Duplex Singlemode Uniboot Patch Cord		FDWLCLC42-JXF007
10' Duplex Singlemode Patch Cords		FEWLCLC42-JXF010
10' Duplex Singlemode Uniboot Patch Cords		FDWLCLC42-JXF010

Non-CommScope MATERIAL LIST

MANUFACTURER	DESCRIPTION	PRODUCT NUMBER	NOTES
Great Lakes	12U-25U wall mounted cabinet	GL##WMCMP-B-SH-AF-00	## indicates height, 24" 36" and 48" are available. 24" for press box applications. 36" and 48" for IDF applications
Chatsworth	12U-21U wall mount cabinet	11996-7**	This product is an acceptable alternate if the Great Lakes cabinet above is unavailable. CUBE-iT wall-mount cabinet. Replace ** with 24 for tempered glass door for Press box application. Replace ** with 36 for IDF application.
Panduit	LD non-metallic series low voltage, one-piece hinged design, single channel surface raceway includes adhesive backing and is made of impact resistant material with a smooth finish that will not scratch, peel, or corrode. The raceway includes an assortment of bend radius and standard fittings that complement the offering to help route, protect, and conceal low voltage data, voice, and video cabling	Pan-Way LD surface raceway system.	Coordinate with architect and owner on color.
Dynacom	Unwired, 66-Style Termination Block with clear, hinged cover	66M1-50	Provide one (1) for each 25-pair demarcation extension cable

END OF SECTION

SECTION 27 4115
PERFORMANCE AUDIO-VISUAL SYSTEMS AND EQUIPMENT

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.
- B. Architectural, structural, mechanical, electrical, and other applicable documents and drawings are considered a part of the Performance Audio-Visual Systems and Equipment (hereafter referred to as AV Systems) documents insofar as they apply as if referred to in full.

1.02 DESCRIPTION OF THE WORK

- A. The following systems are considered part of this project. The complete AV System for each area is comprised of several independent subsystems, and includes, but is not limited to the following areas:
 - 1. Coordination of AV Systems needs with the electrical systems installation contractor as outlined in the Drawings and Specifications.
 - 2. Coordination of AV Systems needs with structural systems installation contractor as outlined in the Drawings and Specifications.
 - 3. Coordination of AV Systems needs with the technology/data systems installation contractor as outlined in the Drawings and Specifications.
 - 4. Coordination of AV Systems needs with all other trades, as required to successfully install systems functioning in accordance with the intent expressed in the Drawings and Specifications.
 - 5. Field-verify all conditions, dimensions, and routing. Fully comply with the Contract Documents, including, and without limitation, the need to check, confirm, and coordinate work with that of other disciplines.
 - 6. Removal of existing Sound Reinforcement / Audiovisual system:
 - a. Removal of existing local sound reinforcement system devices, to include all loudspeakers and mounts, mixing consoles, equipment racks, processing, amplifiers, ALS systems, wireless microphone systems, AV system wall plates and associated cabling, antennae, and projection screen.
 - b. Take care to preserve existing condition of all existing equipment being removed.
 - c. Audio devices associated with school PA/Intercom are beyond this scope of work.
 - d. Turn over all equipment to Owner.
 - 7. Installation, configuration, and training for new Sound and AV systems and equipment at the Auditorium as follows:
 - a. Sound reinforcement system, to include all supporting amplification.
 - b. Digital Signal Processing system for use with preamplification, processing, and routing of audio sources, to include all supporting network devices and companion electronics.
 - c. Bluetooth portable audio device connectivity.
 - d. Back-of-house and Lobby audio and video monitoring systems, for stage monitoring.
 - e. Wired and Wireless production intercom systems.
 - f. Wired and Wireless Microphone systems.
 - g. FM Assistive listening systems for hearing-impaired accessibility.
 - h. Video encoding, distribution, and decoding devices.
 - i. Video projection system.
 - 8. Installation, configuration, and training for new Sound system and equipment at the Black Box as follows:
 - a. Sound reinforcement system, to include all supporting amplification.

- b. Digital Signal Processing system for use with preamplification, processing, and routing of audio sources, to include all supporting network devices and companion electronics.
 - c. Portable mixing console.
 - d. Bluetooth / Multi-I/O connectivity to support portable audio devices as well as audio associated with OFE portable video display cart.
 - e. Wired production intercom system.
 - f. Wired and Wireless Microphone systems.
 - g. FM Assistive listening systems for hearing-impaired accessibility.
 - h. Video encoding, distribution, and decoding devices.
 - i. Video projection system.
9. Loose equipment package including microphones, stands, and cables for flexible use throughout the facility.
10. Cable, connectors, wall plates, and other hardware and accessories, as required, to furnish a complete working system.

1.03 SCOPE OF THE WORK

- A. These Specifications, together with the related drawings and General Conditions of the contract, comprise the requirements for the AV Systems for the project.
- B. Furnish, deliver, erect, install and connect completely all of the material and appliances described herein and in the Drawings, and supply all other incidental material and appliances, tools, transportation, etc., required to make the work complete, and to leave the Sound Systems in first class operating condition, excluding those items listed under GENERAL, 1.10, RELATED WORK IN OTHER SECTIONS.
- C. Perform all assembly of equipment, wiring and inter-connection and soldering of wires to jacks, devices, terminals or equipment, using technical employees only, who are experienced in the installation of AV equipment and its inter-connection. Coordinate final utility rough-in locations with actual equipment furnished.
- D. Verify dimensions and conditions at the job site prior to installation, and perform installation in accordance with these Specifications, manufacturers' recommendations and all applicable code requirements.

1.04 QUALITY ASSURANCE

- A. The intent of these Specifications is to describe and provide for complete AV Systems of high professional quality and reliability. Professional performance standards by the AV Systems Contractor (hereafter referred to as Installer) and the equipment will be required.
- B. In all cases, the Owner and Consultant shall determine the acceptability of the work based upon the visits, observations, and reports of the AV Systems Consultant (hereafter referred to as Consultant).

1.05 SUBSTITUTIONS

- A. Refer to Division 01 for specific substitution procedures and submittal requirements.
- B. Many items are listed in the Specifications by the manufacturer's type or model number, without a detailed performance specification, and may not include the phrase "or approved equal". Where this is the case, no substitutions will be accepted.

- C. Where the phrase "or approved equal" appears, the item specified shall set a standard of quality and performance, based on the published specifications of the manufacturer and on the actual performance as known by the Consultant. Requests for substitution shall be submitted in writing and forwarded to the Consultant no less than five (5) business days prior to the project's scheduled bid date. No substitution will be accepted without written approval from the Consultant to the Installer.
- D. Requests for substitution, when forwarded by the Installer to the Consultant, are understood to mean that the Installer represents that he has personally investigated the proposed substitute product and determined that it is equal to or superior in all respects to that specified, that the same guarantee will be provided for the substitution as for the specified product, and that the Installer will coordinate the installation of the accepted substitute, making such changes as may be required for the work to be complete in all respects.
- E. Substitutions will not be considered if they are indicated or implied in Shop Drawing submissions without previous formal request, or, for their implementation, they require a substantial revision of the Contract Documents in order to accommodate their use.
- F. Space allocations and utility rough-ins have been designed on the basis of equipment items named by manufacturer and model number. If any equipment not so named is offered which differs substantially in dimension or configuration from the named equipment, provide scaled shop drawings showing that the substitute can be installed in the space available without interfering with other trades or with access for operation and maintenance in the completed project. The Installer shall coordinate final utility rough-in locations with actual equipment furnished.
- G. Many Basis of Design products are specific as to infrastructure requirements, and such infrastructure has been specifically designed for the Basis of Design products listed. Where substitute equipment requiring different arrangement or connections from those shown in the Contract Documents is accepted by the Consultant, install the equipment to operate properly and in harmony with the intent of the Drawings and Specifications, making all necessary incidental changes without increasing the Contract amount. Facilitate revisions and modifications with impacted disciplines and trades, and pay all additional costs incurred by adjoining or connecting trades for implementation of such modifications.
- H. All requests for substitutions shall be submitted five (5) business days before the bid opening date. Substitutions shall be requested and approved in writing only, based upon these criteria.

1.06 INSTALLER QUALIFICATIONS

- A. The work performed under this Section shall be performed by an AV Systems contractor, normally engaged in the business of AV Systems installation. The prospective contractor shall show proof, as part of the bid that the contractor has been in the AV Systems installation business for a period of not less than five years and has successfully completed projects of similar size and scope.
- B. Each bidder shall hold a current, valid franchise for the major lines of sound equipment furnished by him under these Specifications.
- C. The Owner and Consultant reserve the right to reject any bids submitted by firms without sufficient experience in projects of similar size and scope.

1.07 COOPERATION AND COORDINATION

- A. Cooperate and coordinate as shown with the other contractors who are responsible for work not included in this section.

- B. Provide any and all information as shown or requested by the Owner, Consultant, or General Contractor in order for this work to be completed to the satisfaction of the Owner, and in the best interests of the Project. Such assistance or information shall be transmitted in writing to the requesting party in all cases. All written correspondence shall be copied to the Consultant.

1.08 GUARANTEE AND WARRANTY

- A. Guarantee all parts, labor, and workmanship furnished under this contract for a period of twelve months from the date of substantial completion.
- B. During the warranty period, report to the site and repair or replace any defective materials or workmanship without cost to the Owner. Warranty service shall be rendered within 24 hours after request by the Owner. Equivalent replacement equipment shall be temporarily provided when immediate on-site repairs cannot be made.
- C. Where warranties on individual pieces of equipment exceed twelve months, the guarantee period shall be extended to the warranty period of the particular items.
- D. Furnish complete and working AV Systems. Be of maximum assistance to the Owner during the guarantee period of the system, to the degree that maximum Owner satisfaction is assured.
- E. After completion of the work, the Installer shall submit a Certificate of Warranty, stating commence and expiration dates and conditions of the warranty, for signature of both parties. Incremental warranties for completed portions of the work may be negotiated at the discretion of the Owner, if delays occur beyond the control of the Installer.

1.09 SHOP DRAWINGS AND SUBMITTALS

- A. Completely detailed shop drawings shall be prepared prior to the procurement of equipment or commencement of work. Electronic files of select drawings will be made available to the Installer from the Consultant. A digital files disclaimer shall be signed and returned by the Installer to the Consultant prior to release of such files. The available drawings shall include only: (1) Legend/Power requirements, (2) Conduit Riser, (3) Floor and Reflected Ceiling Plans, (4) Section Views. Drawings shall be prepared and submitted in electronic format, and as directed by the Architect. Equipment lists, data sheets, etc. shall be 8-½" x 11" size, properly bound into a single electronic format file. Submit in accordance with Division 1, General Requirements.
- B. Within 10 days after the notice to proceed, submit to the Consultant identical copies of the following for approval:
 - 1. A complete equipment list, with manufacturers' names, model numbers, and quantities of each item.
 - 2. Manufacturers' data sheets on all equipment items.
 - 3. Equipment rack layouts showing locations of all rack mounted equipment items.
 - 4. Floor plans and reflected ceiling plans, prepared at a scale of not less than 1/8"=1'-0", showing loudspeaker locations and orientation, junction box and wall plate locations, and all other related device locations.
 - 5. Proposed construction details for any manufacturer-supplied, third party, and custom fabricated items, including interface panels, patch panels and patchbays, wall plates, speaker mounts and rigging details. These details shall show dimensions, materials, finishes and color selection.

6. Coordinate with the Architect / Owner regarding color selection of each equipment item and associated mount / mounting hardware for any, and all, exposed devices. Provide factory color options for review in submittal package. The Installer shall request written confirmation from the Architect / Owner on all such devices prior to ordering. Where the Architect's color selection is not a factory color option, the Installer shall coordinate with the device manufacturer for custom color/paint, where available, and, if not available, coordinate with the General Contractor and other trades for field painting.
 7. Comprehensive system schematics, showing detailed connections to all equipment, with wire numbers, terminal block numbers, and color coding.
 8. Riser diagrams showing conduit requirements with pull boxes, outlet boxes, physical cable layouts, part numbers of cable types used, and number of circuits in each conduit.
 9. Electrical power requirements for head-end and ancillary equipment. Include diagrams for any remote control of electrical power, in sufficient detail to coordinate with the electrical contractor, showing exact conduit requirements and locations for power service receptacles.
 10. Certain other submittals as noted elsewhere in this specification, and as may be required for various equipment items prior to construction, fabrication, or finishing of that item.
 11. Submission of the AV Contract Documents / Bid Documents does not constitute a legitimate submittal and will not be accepted.
- C. Incomplete submittals will not be reviewed. Complete Shop Drawings and Product Data shall be submitted as a singular submittal.
- D. All final documentation shall be submitted and approved before final acceptance by the Owner will be granted. Submit the following in accordance with Division 1, General Requirements. The Installer shall provide final documentation in both hard copy and electronic formats. Suitable electronic formats include Microsoft Word and Excel, AutoDesk (.dwg, .dxf), and Adobe Acrobat (.pdf).
1. A complete as-installed equipment list, listed by room, with manufacturers' names, model numbers, serial numbers, and quantities of each item.
 2. A complete and correct system schematic, showing detailed connections for all parts of the system, including wire numbers, terminal block numbers and layouts, and other designations and codes. System performance measurements as noted elsewhere in this specification shall be documented. Include diagrams or charts showing final settings of all control knobs in the system (mixers, equalizers, power amplifiers, etc.). Submit copies of software settings of each piece of equipment that is software controlled.
 3. Network configuration and routing settings for all network-connected equipment in scope including, but not limited to, the following:
 - a. Full IP settings and addressing for each device.
 - b. Network switch configurations, to include settings for VLANs, QoS, DiffServ, IGMP, and any other setting required for proper AV-network performance.
 - c. Configuration and routing parameters for any Audio / AV-over-IP protocol, to include Dante, QLAN, AES67, AVB, Milan, or any other standard protocol, variant, or proprietary communication platform.
 4. Complete equipment rack layouts showing locations of all rack mounted equipment items.
 5. Floor plans and reflected ceiling plans, prepared at a scale of not less than 1/8"=1'-0", showing loudspeaker locations and orientation, wall plates, rack locations, and other related device locations.
 6. Riser diagrams showing as-installed conduit with pull boxes, outlet boxes, physical cable layouts, part numbers of cable types used, and number of circuits in each conduit.
 7. Repair parts lists for each and every major equipment item furnished.
 8. Manufacturer's warranties and operating instructions for each and every equipment item furnished. Include a copy of the certificate of warranty, signed by both parties.

9. Technical Systems Operations Manual, custom-written by the Contractor, for the purpose of instructing the Owner's operating personnel in the detailed step-by-step operation of the system and preventive maintenance procedures. This manual shall include descriptions of the system components and their relationship to system function. This manual shall be bound separately and labeled appropriately.
10. Incomplete submittals will not be reviewed.

1.10 RELATED WORK IN OTHER SECTIONS

- A. All conduit with pull strings, all electrical pull boxes, and all outlet boxes shall be furnished and installed under the electrical section of Division 26. Coordinate as necessary for proper installation.
- B. All 120VAC power conductors and conduits associated with power circuits to all equipment locations shall be furnished and installed under the electrical section of Division 26. The 120VAC power to the equipment racks shall be terminated inside the racks to AV Installer-supplied isolated ground multi-circuit modular raceway receptacles.
- C. An insulated THW stranded copper ground wire, sized according to NEC, shall be installed under the electrical section of Division 26 from the equipment racks sheet metal to the primary ground point within the building, and terminated at each end to bare metal using approved connectors and clamps.
- D. All built-in millwork and any grille cloth shall be furnished under other sections.
- E. Advisory electrical circuits shown in the AV System drawings are for reference only in depicting the number of electrical circuits needed for operation of these systems.
- F. Advisory datacomm circuits shown in the AV System drawings associated with the building data network are for reference only in depicting the number of network drop locations needed for operation of these systems.
 1. Datacomm circuits associated with the dedicated AV-NET data network are wholly within the AV Contractor's scope of work, as specified in this Section and shown in the accompanying drawings.
- G. Broadband signal feeds.
- H. Satellite signal feeds and equipment.

PART 2 – PRODUCTS

2.01 GENERAL

- A. All items shall be new and unused.
- B. The following sections specifically list the acceptable equipment types and items for this project. Where quantities are not noted, they may be obtained from the drawings. In the event of a discrepancy between the specifications and the drawings, the greater quantity or better quality shall be furnished.
- C. Refer to Part 1.05 SUBSTITUTIONS of this Specification Section.

2.02 WIRE & CABLE

- A. All wire and cables shall be new and unused.
- B. Wire not installed in equipment racks, not portable, or not installed in conduit shall be fire-rated and meet all applicable codes. Plenum-rated cable can only be used, if at all, in locations specified in the associated AV-series drawings. The systems contained in the system package are designed around standard PVC jacketed cable and EMT conduit.
- C. Any and all exposed exterior cabling shall be UV rated.

- D. Furnish and install the following, in quantities and lengths as required. Equivalent cable from other manufacturers may be considered.
- E. Voice coil loudspeakers:
 - 1. High frequency devices (bi/tri-amped systems only): West Penn 226 14AWG twisted pair.
 - 2. Mid frequency devices and speaker monitor circuits (bi/tri-amped systems only): West Penn 227 12AWG twisted pair.
 - 3. Low frequency and Full-Range devices: West Penn HA210 10AWG twisted pair.
- F. Constant voltage (70.7-volt) loudspeaker cable:
 - 1. Runs of less than 200 feet: West Penn 225 stranded 16AWG jacketed twisted pair.
 - 2. Runs of 200' to 300': West Penn 226 stranded 14AWG jacketed twisted pair.
 - 3. Runs of 300' to 500': West Penn 227 stranded 12AWG jacketed twisted pair.
 - 4. Runs of 500' or more: West Penn HA210 stranded 10AWG jacketed twisted pair.
- G. Audio Cable:
 - 1. Microphone-level audio cable (installed in conduit, not portable): West Penn Wire 452 stranded 22AWG twisted pair with foil shield.
 - 2. Line-level audio cable and all inter-rack audio cable: West Penn Wire 452 stranded 22AWG jacketed twisted pair with foil shield.
 - 3. Exterior and below-grade Microphone and Line level cable: West Penn AQ293 stranded 18AWG twisted pair with foil shield.
- H. Production Intercom cable (installed in conduit, not portable):
 - 1. 1-Channel: West Penn 293 stranded 18AWG twisted pair with foil shield.
 - 2. 2-Channel: West Penn D440 2-pair stranded 18AWG twisted pair with individual foil shield per pair.
 - 3. 4-Channel: West Penn D442 4-pair stranded 18AWG twisted pair with individual foil shield per pair.
 - 4. Outdoor Production Intercom Cable (exposed directly to sunlight/weather or installed in conduit below grade): West Penn AQ293 stranded 18AWG twisted pair with foil shield.
- I. Wireless microphone and RF Assistive Listening System antenna cable:
 - 1. For runs less than 50 feet: Belden 9310, 50-ohm RG-58A/U coaxial cable with appropriate connectors.
 - 2. For runs that exceed 50 feet: Belden 9914, 50-ohm RG-8A/U type coaxial cable with appropriate connectors.
- J. Data cable (copper) for networked Audiovisual systems:
 - 1. Installed Data cable: Panduit PUR6AV04*-G 23AWG Cat6a UTP, or approved equal conforming to project standard. * = color.
 - 2. Data Patch cables: Panduit UTP28X*^ series 28AWG Cat6a UTP patch cables, or approved equal conforming to project standard. Provide in lengths required for applicable devices. * = length, ^ = color.
- K. Fiber-Optic Cable for networked Audiovisual systems:
 - 1. Panduit Opti-Core FOIRZ02Y 50µm OM4 2-strand Multimode Duplex Fiber Cable.
- L. Other equipment control cables shall be stranded wire, appropriately shielded, of gauge and number of conductors required by the manufacturer for proper operation of the system or equipment item furnished.
- M. Wire and cable for all other devices shall be supplied in accordance with the recommendations of the device manufacturer and the National Electrical Code.

2.03 JACKS, CONNECTORS, AND WALL PLATES

- A. All plate-mounted connectors shall be ground-insulated from the plates on which they are mounted.

- B. Floor-mounted jacks, unless noted otherwise, shall be installed in floor boxes. The interior plates shall be anodized black. Nomenclature shall be engraved into the interior plate of each floor box with 1/8" block letters filled with white paint. Coordinate floor box insert connector plates with actual floor boxes provided.
- C. For non-standard custom panels, connectors shall be installed on 1/8" thick black anodized aluminum or brushed stainless steel panels. Nomenclature shall be engraved into the plate with 1/8" block letters filled with contrasting paint color. Coordinate final finish selection with Architect prior to Shop Drawing submittals.
- D. All other jacks shall be installed on standard brushed stainless steel finish plates. Nomenclature shall be engraved into the plate with 1/8" block letters filled with black paint.
- E. All AV signal circuit locations shall be numbered logically and consecutively for each circuit/signal type, starting from one (1).
- F. All plate-mounted jacks at exterior locations shall be provided with captive sealing covers.
- G. Unless otherwise specified, all jacks and connectors for the AV Systems shall be as follows, or approved equal:
 - 1. Audio connectors:
 - a. Microphone and line-level input jacks (XLR type): Neutrik NC3FD-L-B-1 3-pin female XLR panel-mount jacks with gold-plated contacts.
 - b. Audio output jacks (XLR type): Neutrik NC3MD-L-B-1 3-pin male XLR panel-mount jacks with gold-plated contacts.
 - c. Production Intercom chassis mounted connectors: Neutrik NC6MSD-L-1 6-pin XLR Male conforming to Switchcraft pin configuration, or approved equal by Switchcraft.
 - d. Female cable-end audio connectors: Neutrik NC3FX-B 3-pin female XLR connectors with gold-plated contacts.
 - e. Male cable-end audio connectors: Neutrik NC3MX-B 3-pin male XLR connectors with gold-plated contacts.
 - 2. Video and RF connectors:
 - a. BNC chassis mounted connector (75-Ohm): Neutrik NBB75DFIX Isolated UHD/4K BNC Bulkhead Jack.
 - b. BNC chassis mounted connector (50-Ohm): Amphenol Connex 112443 BNC Bulkhead Jack.
 - c. BNC cable mounted connector (75-ohm): Kings 2065-10-9 3G-SDI (SMPTE 424M) crimp cable connector.
 - 3. Loudspeaker connectors:
 - a. Chassis mounted speaker connectors: Neutrik NL4MPXX 4-pole locking jack, or approved equal.
 - b. Cable mounted speaker connectors: Neutrik NL4XX-W-* 4-pole locking plug, or approved equal. * = size, provide model with strain relief chuck size corresponding to outer diameter of speaker cabling supplied.
 - 4. Network Data connectors:
 - a. CAT6A chassis mounted connector: Neutrik NE8FDX-Y6-B CAT6A Shielded Bulkhead Jack, Black with rear IDC terminations.
 - b. CAT6A chassis mounted connector (IP65 Rated): Neutrik NE8FDX-Y6-W CAT6A Shielded Bulkhead Jack, Black with rear IDC terminations, and integrated sealing cover. These devices are associated with any configuration at a non-conditioned or exterior location.
 - c. CAT6A cable connectors: Panduit FP6X88MTG Cat6a straight field term plug, or approved equal.
 - 5. Fiber optic connectors:
 - a. Field-terminated fiber optic connectors shall not be accepted. Contractor shall fusion splice factory terminated duplex LC pigtails or patch cords of appropriate mode and wavelength to installed fiber optic cabling associated with AV System equipment.

6. Power Sequencing Remote Low-Voltage connectors:
 - a. Provide connectors for use with remote connections for power sequencing switch sets and standalone sequenced power modules. Connectors shall be in an industry standard form factor with an uncommon pin configuration to alleviate any mis-connection from standard audio, production intercom, or DMX systems.
 - b. Chassis-mount 4-pin XLR male: Neutrik NC4MD-L-B-1 4-pole male receptacle with gold contacts and black metal housing.
 - c. Chassis-mount 4-pin XLR female: Neutrik NC4FD-L-B-1 4-pole female receptacle with gold contacts and black metal housing.
 - d. Cable-mount 4-pin XLR male: Neutrik NC4MX-B 4-pole male cable connector with black metal housing and gold contacts.
 - e. Cable-mount 4-pin XLR female: Neutrik NC4FX-B 4-pole female cable connector with black metal housing and gold contacts.
 7. Power connectors for portable systems:
 - a. Chassis mounted: Neutrik NAC3MPX-TOP chassis-mounted power inlet connector.
 - b. Portable power cable assembly: 25-foot 12/3 SJO flexible power cable terminated in Neutrik NAC3FX-W-TOP at one end and 15-amp Edison plug (Nema 5-15 male) at the other.
- H. Furnish and install the required number of jacks and connectors as indicated on the drawings.

2.04 EQUIPMENT RACKS

- A. Furnish equipment racks for use in housing Audiovisual equipment including, but not limited to, power amplifiers, signal processors, input/output devices, playback equipment, intercom equipment, etc., and ancillary devices necessary to the operation of the system. Provide a ¼" (nominal) non-conductive industrial-grade black rubber mat under each floor-mounted cabinet trimmed to the footprint of the cabinet for isolation from building structure.
- B. Each equipment rack shall include a locking front and rear doors, side panels, and top and bottom panels unless otherwise noted.
- C. Equipment rack colors shall be flat black.
- D. Heat-producing components shall be mounted with one RU blank panel installed between units, or as the manufacturer recommends. Fill all other unused portions of rack front sections with matching blank panels
- E. Furnish (5) sets of spare keys for each equipment rack.
- F. All mounting screws shall be theft resistant.
- G. Install the required number of units, of sufficient size to accommodate the equipment specified, at the locations indicated in the drawings.
- H. At locations / systems with power sequencing, configure so that power amplifiers and active loudspeakers are the last to turn on in system power-up sequence and first to turn off in power-down sequence.
- I. Furnish and install the following, or approved equal:
 1. Floor Mounted Equipment Rack (ER): Middle Atlantic Products WRK-44SA-32 stand-alone equipment rack, to include rear door, FD-44 locking solid front door, WRK-RR-44 rear rack rail kit and MW-4QT-FC integrated fan top for each cabinet, as required. Provide all accessories as required for proper installation and support of all devices at each location. Provide (1) Middle Atlantic LT-GN-WL magnetic gooseneck worklight for each unit supplied. (Qty: 1 ea.)

2. AV Equipment Desk (DSK): HSA Rolltops INSEXT-II with PLUS4 4" additional height option and INSRKWIDE width accommodation option for slide out rotating rack at side equipment rack bay. To include rear modesty panel. Reference drawing #23078 when contacting the manufacturer. Coordinate with Architect regarding factory stain/finish selection. Provide and install Middle Atlantic Products SRSR-4-16 16RU slide out rotating rack at side equipment rack bay. (Qty: 1 ea.)
3. Wall Mount Equipment Rack at Auditorium Stage (WR): Middle Atlantic Products DWR-24-22, to include FD-24 locking solid front door. (Qty: as shown)
4. Wall Mount Equipment Rack at Black Box Control Booth (WR): Middle Atlantic Products SR-40-28 pivoting wall rack, to include FD-40 locking solid front door, FWD-DWR-RR40 rear rack rails, DWRSR-6-FK fan kit, and FC-DC thermostatic fan controller. (Qty: as shown)
5. Portable Mixer Rack at Black Box: Grundorf T8-TLR1224-TM7B mixer rack rack for specified digital mixing console, to include RRR rear rack rail and TLR8-24-LC2B Caster Base options. (Qty: 1 ea.)
6. Portable Rack for storage of wireless microphone transmitters and chargers: Grundorf T8-AR1616 16RU rack (black finish) with AR8-16-LC2B 4" Caster Base (2 casters with brakes). (Qty: 1 ea.)
7. Multi-circuit Power Sequencing at Auditorium:
 - a. Power Sequencer Controller at "ER" Rack: Middle Atlantic Products USC-6R sequencing controller. Provide Middle Atlantic Products MPR series modular raceways at each rack with RLM-20IGA (20-amp sequenced isolated ground) and M-20IGA (20-amp non-sequenced isolated ground) power modules, and RLM-20-1CA (20-amp sequenced stand-alone modules for remote locations/equipment); provide configuration and all manufacturer accessories to support requirements shown on associated Advisory Audiovisual Power Requirements drawing sheet detail. Interface control contacts with AV control system for system power control via touch control screens. DSP and Network Switch shall be served from non-sequenced, non-switched outlets. Coordinate with the Div. 26 Electrical Contractor for termination of 120VAC circuits associated with the power sequencing system raceway modules. Configure so that all power amplifiers are cycled off first and powered on last, in order to avoid transients/pops potentially harmful to loudspeakers. (Qty: as required)
8. Single-circuit Power Sequencing at Black Box:
 - a. Middle Atlantic Products PDS-620R single-circuit sequenced power distribution unit. Interface control contacts with AV control system for system power control via touch control screens. Configure outlet sequence order so that amplifiers are turned on last and powered down first. (Qty: 1 ea.)
9. Rackmount Power Strip: Middle Atlantic PD-920R-NS. (Qty: as required to accommodate power for multiple rack mounted devices served from single power circuit at fixed rack locations)
10. Rackmount Power Strips with Retractable Front Light: Radial Engineering POWER-2. (Qty: as shown)
11. Brush Grommet Panel: Middle Atlantic BR1. (Qty: as shown)
12. Rack Recessing Panels:
 - a. Middle Atlantic RR2-3RCN Rack Rail Recessor, 2 rack units (pair), 3" deep. (Qty: as shown)
 - b. Middle Atlantic CN1032-50 Cage Nuts for recessors (50-count). (Qty: as required)
13. Rack shelves:
 - a. Middle Atlantic U1 1RU rack shelf. (Qty: as shown)
14. Rack Blank Panels:
 - a. Middle Atlantic BL1 1RU black brushed and anodized blank panel. (Qty: as shown)
 - b. Middle Atlantic BL2 2RU black brushed and anodized blank panel. (Qty: as shown)
15. Rack Vent Panels:

- a. Middle Atlantic VT1 1RU black powder coated vent panel. (Qty: as shown)
- b. Middle Atlantic VT2 2RU black powder coated vent panel. (Qty: as shown)
- 16. Rack drawers:
 - a. Middle Atlantic D2 2RU rack drawer. (Qty: as shown)
 - b. Middle Atlantic D3LK 3RU rack drawer with lock. (Qty: as shown)
- 17. Sliding Rack Shelf: Middle Atlantic SS Sliding Rack Shelf. (Qty: as shown)

2.05 DIGITAL SIGNAL PROCESSOR

- A. The audio processing shall be in the digital domain following the input source and shall remain until power amplification is required.
- B. All network connections to be coordinated with the Owner's network representatives. The Owner's IT department to set-up static IP addresses in association with the Installer.
- C. Provide all data interconnection cabling as shown.
- D. System programmer shall be QSys Level 2 certified or otherwise advanced manufacturer-certified for programming any respective approved substitute DSP product/system.
- E. Include all licensing for DSP plug-ins and Dante™ routing by software, as required.
- F. The system processor shall provide up to 64 x 64 networked audio channels individually configurable as either Q-LAN or AES67 formatted networked audio. Additionally, the system processor shall include 8 x 8 Software-based Dante network audio channels and is licensable for up to 32 x 32 Software-based Dante capacity. Software-based Dante channels used subtract from the overall 64 x 64 network audio capacity.
- G. The system processor shall support an 8-channel total analog I/O capacity and shall be presented as 8 Flex Channel I/O which shall be software definable as analog inputs or outputs in single channel increments in any combination ratio.
- H. The system processor shall have the following front panel controls and indicators: Unit ID button and Power On blue LED. Device Status, monitoring, and logging shall be provided by a standard web interface. On the rear panel, the system processor shall have two 3-pin RS232 Euro Block Connectors, 8 GPI general purpose control inputs on a 10-pin Euro Block Connector, 8 GPO general purpose control outputs on a 10-pin Euro Block Connector, USB C and B connectors to support AV bridging with QSC Q-SYS cameras and/or present itself as one or more multi-channel USB audio interfaces. Q-SYS Network: LAN A RJ45 1000 Mbps only, LAN B: RJ45 1000 Mbps only.
- I. The system processor shall operate from a single design, which can be comprised of components, wiring, links, text, and graphics on a single or multiple schematic pages. Designs shall include any of the following DSP function blocks, test and measurement components, control components, and layout components: Acoustic Echo Cancellers, SIP Softphone instances, USB Audio host and device blocks, Audio Players, Audio Streaming components, Crossfaders, Crossovers, Delay components, Auto Gain control elements, Compressors, Gates, Duckers, Expanders, Ambient Noise Compensators, Limiters, Gain blocks, Graphic Equalizers, Parametric Equalizers, FIR Filters, All-Pass Filters, Band-Pass Filters, Band-Stop Filters, High-Pass Filters, Low-Pass Filters, FIR High-Pass filters, FIR Low-Pass Filters, Dual-Shelf Equalizers, Notch Filters, Meters, Matrix Mixers, Gain-Sharing Automatic Mixers, Gated Automatic Mixers, Signal Routers, Public Address Routers, Room Combiners, Signal Presence Meters, Tone Generators, Tone and Noise Generators, Dual Trace FFT Measurement Modules, Real Time Analyzers, Signal Injectors, and Signal Probes.
- J. The system processor shall support custom user control interfaces on either proprietary touch screen controllers, network computers utilizing a control application, iOS devices, or any device with a standard web browser. Custom control interfaces shall be capable of having multiple user-selectable pages with different controls on each. All GUI's shall be submitted to the consultant for approval prior to programming and finalization.

- K. Furnish and install the following as indicated in the accompanying Audiovisual drawings, or approved equal:
1. Digital Signal Processor (DSP): QSC Q-Sys CORE 8-FLEX. (Qty: as shown)
 2. Audio input expander: QSC Q-Sys QIO-ML4i. (Qty: as shown)
 3. Audio input/output expander: QSC Q-Sys QIO-ML2x2. (Qty: as shown)
 4. Rackmount kit for expander modules: QSC Q-Sys QIO-RMK. (Qty: as required to support modules at each location)
 5. Rackmount Touch Control Panel: QSC TSC-70-G3 7" touch control panel, to include mounting bracket. This device is associated with the stage manager rack (WR) at the Auditorium stage. (Qty: as shown)
 6. Desktop Touch Control Panel: QSC TSC-70-G3 7" touch control panel, to be supplied with TSC-710T-G3 desktop stand accessory. Mount at "DSK" AV equipment desk. (Qty: as shown)
 7. Type "C" Touch Control Panel: QSC TSC-70-G3 7" touch control panel, to include mounting bracket. (Qty: as shown)
 8. Type "BT" Bluetooth / Multi-I/O wall plate: Attero Tech by QSC unD6IO-BT Dante Networked Audio Wall Plate, to include matching 2-gang decora cover plate. (Qty: as shown)
 9. Network Switches: Aruba Instant On JL686B 1930-series 48-Port switch with 48x 1G PoE+ RJ45 ports, 4x 1/10GbE SFP/SFP+ ports, 370W PoE+ power budget. (Qty: as shown)
 10. Network Switches: Aruba Instant On JL684B 1930-series 24-Port switch with 24x 1G PoE+ RJ45 ports, 4x 1/10GbE SFP/SFP+ ports, 370W PoE+ power budget. (Qty: as shown)
 11. Multimode Transceivers for Network Switches: Aruba Instant On R9D18A 10GBase-SR short reach 10G multimode transceiver with LC duplex connector for use with OM3 MM fiber. (Qty: as shown)
 12. Type "AP" Wireless Access Point: Aruba Instant On AP15 PoE-powered dual-band 802.11ax Wi-Fi access point. This device is dedicated to the AV system data network and is not associated with any building network functionality. (Qty: as shown)
- L. Successful Contractor shall be responsible for programming each software configuration file for each system based on intended functionality shown, or implied, in the drawings.
1. Each system shall be programmed so the default operating condition is auto-populated upon system power-up.
 2. Interface with the presentation and control system at each applicable space and program associated touch control panels for user control of all parameters necessary for successful control and operation of connected devices in each system.
 3. As part of the touch control panel programming, include dedicated functions for mute/unmute of the Auditorium ambient microphone.
 4. As part of the touch control panel programming, include level and mute functions for the lobby loudspeaker.
 5. At locations where touch control screens are intended to be the mechanism by which system power is controlled, program touch control screens for this functionality, ensuring associated DSP, Control Processor, and Network Switch devices are powered from non-sequenced, non-switched power outlets.
 6. Terminate and program fire alarm interface at each system. Each system shall be programmed to mute all program audio upon receipt of contact closure from the addressable fire alarm module, provided by fire alarm vendor, at each system location.
 7. Contractor shall provide a review copy of the programming file to the Consultant for review at the latest four (4) weeks prior to scheduled commissioning trip.

2.06 LOUDSPEAKERS

- A. The drawings indicate the loudspeaker positions and aiming points for each loudspeaker.
- B. Loudspeakers shall be mounted to the structure, at the positions and angles indicated relative to the aiming points. Suspend each component with commercial rigging hardware, in such a way as to facilitate minor angle adjustments. Safety factor shall be at least 5. Furnish rigging details during submittal process. Secure any loose hardware to prevent vibration and rattling. Orient each speaker at the location and angles indicated in the drawings. Make minor adjustments as required to provide even sound distribution.
- C. Measure and record the impedance of each driver at the amplifier terminals. High frequency drivers shall be measured at 1000Hz; low frequency drivers shall be measured at 250Hz. Include the measurements in the final documentation.
- D. For loudspeakers incorporating 70.7v transformers/autoformers, tap as indicated in the drawings.
- E. Retain the services of a registered professional structural engineer licensed to practice in the State of project installation to develop mounting details, including attachment to the building structure. Structural information shall include design calculations and a copy of engineer's certification.
- F. Verify factory color option selection with Owner / Architect prior to product acquisition.
- G. Furnish and install the following assemblies, or approved equal:
 - 1. Type "S1" Main Loudspeakers: ElectroVoice EVF-1122S/66 12" loudspeaker with 60°x60° dispersion. To be supplied with EVF-UB mounting yoke. (Qty: as shown)
 - 2. Type "S2" Delay Loudspeakers: ElectroVoice EVF-1122S/66 12" loudspeaker with 60°x60° dispersion. To be supplied with EVF-UB mounting yoke. (Qty: as shown)
 - 3. Type "S3" Front-Fill Loudspeakers: OAP NF-241HP2 dual 4.5" loudspeaker with decorative grille. Re-use existing back box. No substitutions allowed, as loudspeaker must match existing enclosure for identical replacement loudspeaker model. (Qty: as shown)
 - 4. Type "S4" wall-mounted loudspeakers: QSC AD-S8T 8" 70V loudspeaker with nominal 105° conical dispersion. For each unit supplied, provide YMS8T yoke mount. (Qty: as shown)
 - 5. Type "S6" Loudspeaker: QSC E112 12" loudspeaker with 85° conical dispersion. To be supplied with E12YM yoke mount and TMB Pro-Burger PRBHC3/8B 2" pipe clamp for mounting at Black Box pipe grid. (Qty: as shown)
 - 6. Type "SB" Subwoofers: Electrovoice EVA-2151D dual 15" subwoofer. For each unit supplied, provide EVA-EG2 extended rigging grid (primary suspension) and EVA-SG2 standard rigging grid (bottom pickup points). (Qty: as shown)

2.07 CEILING-RECESSED LOUDSPEAKER ASSEMBLIES

- A. Furnish ceiling-recessed loudspeakers at the locations noted on the drawings.
- B. Ceiling-recessed speakers shall be installed in a recessed enclosure, whether it be a separate back can or part of an integrated loudspeaker assembly. Furnish braces designed to provide additional support to the weight of the speaker and prevent tile sag. Coordinate exact locations with the Owner. Connect the loudspeakers as indicated in the drawings. Furnish enclosures/back cans to Division 26 for installation if/where required.
- C. Verify factory loudspeaker color with Architect prior to product acquisition. Baffles shall be painted a color selected by the Arch./Owner. Coordinate with the Architect regarding color selection.
- D. Tap the transformers as indicated in the drawings. Measure and record the impedance at 1000Hz of each home run at the amplifier terminals. Include the measurements in the final documentation.
- E. Furnish and install the following, or approved equal:

1. Type “S5”: Electrovoice EVID C6.2 6.5” 2-way 70v recessed ceiling speaker assembly. (Qty: as shown)

2.08 PORTABLE LOUDSPEAKERS

- A. Furnish portable loudspeakers with accessories for flexible use at the Auditorium.
- B. Furnish the following, or approved equal, passive monitor speakers:
 1. JBL PRX412M 12-inch 2-way Stage utility / monitor speaker. (Qty: 6 ea.)
 2. Whirlwind NL450 “speakon” speaker cable – 50 feet. (Qty: 6 ea.)

2.09 POWER AMPLIFIERS

- A. Provide power amplifiers for use in amplifying audio signals for distribution to the loudspeakers.
- B. Each power amplifier shall have an analog input connector which is either a screw-type barrier strip or XLR type. Networked amplifiers shall incorporate RJ-45 data jacks for network signal and/or control connectivity. Output connectors shall be either barrier strip or Neutrik Speakon connectors. Other types of connectors shall not be accepted. All power amplifiers shall have detented stepping input level controls. Install the units in the main equipment racks and connect as indicated in the drawings.
- C. Provide (1) one amplifier channel for each loudspeaker home run. Size amplifier based on total power consumption of each home run. Locate amplifiers at sound equipment racks associated with each loudspeaker home run / zone.
- D. Furnish and install the following, or approved equal:
 1. 4-channel network amplifiers compatible with specified DSP, 1,000 watts/ch max. @ 8-Ohms and 70V, 1,500 watts/ch max. @ 4-Ohms: QSC CX-Q-4K4. (Qty: as shown)
 2. 4-channel network amplifiers compatible with specified DSP, 1,250 watts/ch max. @ 8-Ohms and 70V, 2,400 watts/ch max. @ 4-Ohms: QSC CX-Q-8K4. (Qty: as shown)
 3. 8-channel network amplifiers compatible with specified DSP, 1,250 watts/ch max. @ 8-Ohms and 70V, 1,500 watts/ch max. @ 4-Ohms: QSC CX-Q-8K8. (Qty: as shown)
 4. 2-channel network amplifiers compatible with specified DSP, 120 watts/ch max. @ 70V Bridged: QSC SPA-Q-60x2. (Qty: as shown)
 5. 4-channel network amplifiers compatible with specified DSP, 120 watts/ch max. @ 70V Bridged: QSC SPA-Q-60x4. (Qty: as shown)

2.10 VOLUME CONTROLS

- A. Furnish wall-mounted volume controls at locations indicated for use in controlling loudspeaker levels within each respective area.
- B. Size each device per total speaker load at each location / zone.
- C. Furnish and install the following, or approved equal:
 1. Type “V”: Lowell Manufacturing **LVC-* 1-gang volume control (**=power rating, *=color). (Qty: as shown)

2.11 PLAYBACK, RECORDING, AND INTERFACE DEVICES

- A. Furnish audio devices to facilitate the use of pre-recorded content or portable media. Connect as indicated on the drawings.
- B. Furnish and install the following, or approved equal:
 1. CD/Media Player with Bluetooth, Aux, and USB inputs: Tascam CD-400U. (Qty: as shown)
 2. Media Recorder: Denon DN-300R-MKII. For each unit supplied, provide (1) one Sandisk Extreme Pro USH-I SDXC 512GB SD Memory Card. (Qty: as shown)

2.12 DIGITAL MIXING CONSOLE

- A. Furnish mixing consoles for use in processing and routing microphone and line level sources.
- B. Provide remote mixing capabilities with wireless tablet via the AV Network Wi-Fi.
- C. The mixing consoles shall have the I/O specified, and be configured on the built-in Dante network in each applicable space.
- D. Configure the consoles prior to commissioning and provide configuration files to consultant for review.
- E. Configure all Dante enabled devices, including wireless microphones and audio recorders, on the console.
- F. Configure all routing of signal from consoles to associated system DSP, via Dante into the Q-SYS platform.
- G. Furnish and install the following at the Auditorium, or approved equal:
 - 1. Digital Mixing Console: 120 mix channels, 48 mix and 12 matrix output busses, 32 in / 16 out local I/O, 24 + 4 master fader configuration, 144x144 Dante digital audio networking: Yamaha DM7. (Qty: 1 ea.)
 - 2. I/O Rack: 32 analog input, 16 analog output, 8 AES/EBU digital outputs, Dante digital audio networking, remote head-amp control from specified mixing console: Yamaha Rio3224-D2. (Qty: 1 ea.)
 - 3. I/O Rack (portable): 16 analog input, 8 analog output, Dante digital audio networking, remote head-amp control from specified mixing console: Yamaha Rio1608-D2. (Qty: 1 ea.). Provide and install the following with the portable I/O rack:
 - a. Portable Equipment Rack: SKB Cases 1SKB-R6UW 6RU rolling rack. (Qty: 1 ea.)
 - b. Rackmount Power Strip with Retractable Front Light: Radial Engineering POWER-2. (Qty: 1 ea.)
 - c. Rack Drawer: Middle Atlantic D2 2RU rack drawer. (Qty: as shown)
 - 4. Wireless controller: Apple iPad Air 64GB Wifi model (verify color). To be provided with Otterbox Defender Series Pro case compatible with tablet model supplied. (Qty: 1 ea.)
- H. Furnish and install the following at the Black Box, or approved equal:
 - 1. Digital Mixing Console: 72 mix channels with 16 local mic/line inputs, 12+4 fader configuration, 48 output busses, and integrated Dante digital audio: Yamaha DM7C. To be supplied with RK1 rackmount kit. Mount at Portable Mixer Rack. (Qty: 1 ea.)
 - 2. Headphones: Audio Technica ATH-M50x. (Qty: 1 ea.)

2.13 WIRELESS MICROPHONE SYSTEMS

- A. Diversity UHF wireless microphone systems shall be used in this facility.
- B. Operating frequency shall be as high as possible, and shall be selected so as to avoid interference.
- C. The Contractor shall perform a Wireless Frequency Scan in order to determine the proper frequency selection for each venue.
- D. Units are to be provided with rackmount kits, in the configurations shown in the accompanying drawings, and installed in equipment racks, whether fixed or portable racks, for use at each applicable venue.
- E. Each system shall be provided on different frequencies so that they can be used simultaneously.
- F. Furnish and install the following wireless systems and accessories, or approved equal, for use at the Auditorium for Production use:
 - 1. Shure ULXD4Q Quad-channel digital wireless receiver. (Qty: 6 ea.)
 - 2. Shure ULXD2/SM58 Wireless handheld transmitter. (Qty: 8 ea.)

3. Shure ULXD1 Wireless bodypack transmitter. (Qty: 24 ea.)
 4. Countryman E6 I-series* (* = B, T, C, LT) standard sensitivity omnidirectional earset microphone with TA4F connector. Verify with the Owner's representative for factory color selection – Black, Tan, Cocoa, or Light Tan. (Qty: 24 ea.)
 5. Shure UA874US Active Directional Antenna, compatible with frequency range(s) of receivers supplied. (Qty: 2 ea.). Remote-mount at type "WL-A" antenna locations.
 6. Shure UA845UWB Active Antenna Distribution Unit. (Qty: 2 ea.)
 7. Shure SB900B Lithium-Ion rechargeable batteries. (Qty: 32 ea.)
 8. Shure SBC800-US 8-Bay battery charging station, to include power supply. (Qty: 4 ea.)
- G. Furnish and install the following wireless systems and accessories, or approved equal, for use at the Auditorium for Default / Assembly use:
1. Shure ULXD4D Dual-channel digital wireless receiver. Remote-mount supplied ½-wave antennas at type "WL-B" antenna locations. (Qty: 1 ea.)
 2. Shure ULXD2/SM58 Wireless handheld transmitter. (Qty: 2 ea.)
 3. Shure ULXD1 Wireless bodypack transmitter. (Qty: 2 ea.)
 4. Countryman E6 I-series* (* = B, T, C, LT) standard sensitivity omnidirectional earset microphone with TA4F connector. Verify with the Owner's representative for factory color selection – Black, Tan, Cocoa, or Light Tan. (Qty: 2 ea.)
 5. Shure SB900B Lithium-Ion rechargeable batteries. (Qty: 4 ea.)
 6. Shure SBC200-US 2-Bay battery charging station, to include power supply. (Qty: 2 ea.)
- H. Furnish and install the following wireless systems and accessories, or approved equal, for use at the Black Box:
1. Shure QLXD124/85 Combination System with QLXD4 digital wireless receiver, QLXD2/SM58 handheld transmitter, and QLXD1 bodypack transmitter. (Qty: 2 ea.). Mount supplied ½-wave antennas at portable mixer rack rear rack panel.
 2. Countryman E6 I-series* (* = B, T, C, LT) standard sensitivity omnidirectional earset microphone with TA4F connector. Verify with the Owner's representative for factory color selection – Black, Tan, Cocoa, or Light Tan. (Qty: 2 ea.)
 3. Shure UA221 passive antenna splitter kit. (Qty: as required)
 4. Shure SB900B Lithium-Ion rechargeable batteries. (Qty: 4 ea.)
 5. Shure SBC200-US 2-Bay battery charging station, to include power supply. (Qty: 2 ea.)

2.14 PRODUCTION INTERCOM SYSTEM

- A. Provide wired and wireless production intercom systems for use in voice communication and personnel coordination during events where indicated in the drawings.
- B. Furnish intercom power supplies in sufficient quantities to accommodate all intercom devices per manufacturer's specifications and recommendations for each system.
- C. Refer to associated Audiovisual drawing package for all device, outlet, and equipment locations.
- D. Furnish and install the following, or approved equal, associated with the Auditorium:
 1. Clear-Com MS-702 master intercom station. Furnish (1) GM-18 gooseneck microphone for each unit supplied. (Qty: 1 ea.)
 2. Clear-Com PS-702 2-channel power supply. (Qty: 1 ea.)
 3. Clear-Com KB-701 1-channel wall speaker station. These devices are associated with Type "IW" and "E4-IW" locations. (Qty: as shown)
 4. Clear-Com RS-702 2-channel wired intercom belt pack. (Qty: 12 ea.)
 5. Clear-Com CC-300 single muff intercom headset w/ flexible dynamic boom mic. (Qty: 12 ea.)
 6. Clear-Com IC-25-2P 25-foot 6-pin XLR-F to XLR-M intercom cable, or approved equal from Whirlwind conforming to SwitchCraft 6-pin configuration. (Qty: 6 ea.)

7. Clear-Com IC-50-2P 50-foot 6-pin XLR-F to XLR-M intercom cable, or approved equal from Whirlwind conforming to SwitchCraft 6-pin configuration. (Qty: 6 ea.)
 8. Clear-Com FSII-BASE-II-5 FreeSpeak II wireless base station with licensing for 5 wireless belt packs. This device can operate in the 1.9GHz and 2.4GHz frequency bands. Provide and configure CCM Core Configuration Manager, on one (1) computer selected by the Owner, for configuration of wireless intercom system parameters. (Qty: 1 ea.)
 9. Clear-Com FSII-BP19 FreeSpeak II 1.9GHz wireless belt pack. For each unit supplied, provide CC-300 single muff intercom headset w/flexible dynamic boom mic. (Qty: 5 ea.)
 10. Clear-Com FSII-TCVR-19-US FreeSpeak II 1.9GHz Transceiver Antenna. (Qty: 2 ea.)
 11. Clear-Com AC60 charger for five belt packs or batteries. (Qty: 1 ea.)
 12. Clear-Com BAT60 rechargeable batteries for wireless belt packs. (Qty: 5 ea.)
- E. Furnish and install the following, or approved equal, associated with the Black Box:
1. Clear-Com PS-702 2-channel power supply. (Qty: 1 ea.)
 2. Clear-Com RS-702 2-channel wired intercom belt pack. (Qty: 6 ea.)
 3. Clear-Com CC-300 single muff intercom headset w/ flexible dynamic boom mic. (Qty: 6 ea.)
 4. Clear-Com IC-25-2P 25-foot 6-pin XLR-F to XLR-M intercom cable, or approved equal from Whirlwind conforming to SwitchCraft 6-pin configuration. (Qty: 6 ea.)

2.15 ASSISTIVE LISTENING SYSTEMS

- A. Furnish and install FM wireless assistive listening systems for use by the hearing-impaired. The assistive listening system (ALS) shall be capable of broadcasting on 57 channels and be frequency agile.
- B. The receiver shall have a programmable multi-function Listen button that can be tuned for the venues desired channels and electronically lock out any unused channels. The receiver shall have a signal-to-noise ratio of 70 dB or greater and shall have an audio frequency response of 50 Hz - 15 kHz (± 3 dB). The device shall employ a unique DSP SQTM noise reduction technology. The unit shall have a programmable squelch circuit. The unit shall incorporate a multi-functional display that indicates battery status, inventory number and channel. The device shall have the option of being lanyard or belt clip worn and the lanyard shall have the option of an integrated neck loop. The device shall have a USB connector used for inventory control, set up, charging and firmware upgrades. The device shall incorporate automatic battery charging circuitry and use a non-proprietary lithium ion battery. The device shall have additional charging contacts to allow multiply charging options.
- C. Supplemental transmission is provided via an assistive listening WiFi server distributed through the building WiFi wireless network. Personal reception is accomplished with a user-installed smartphone app, facilitating wireless connectivity to Bluetooth-enabled hearing aids.
- D. Furnish and install the following, or approved equal, at the Auditorium:
 1. Listen Technologies LS-55-216 iDSP Prime Level 3 Stationary RF System (216 MHz), to include (1) transmitter with rackmount kit, (4) rechargeable personal receivers, (4) intelligent Earphone/Neckloop lanyards, (4) universal ear speakers, 12-unit charging tray, ALS notification signage kit, and accessories. (Qty: 2 complete systems)
 2. Listen Technologies LA-124 90° Helical Antenna (216 MHz). Remote mount at "AL" locations. (Qty: 1 ea.)

2.16 VIDEO / DATA PROJECTORS

- A. Furnish and install high light output video projectors for projection of video, data, and graphic images on the projection screens in the areas as indicated.

- B. Perform all setup procedures and image convergence for each input according to the manufacturer's recommendations. The image shall be adjusted for full available screen width for each input.
- C. Coordinate the exact location of the projector mount with the Architect and Project Manager/Designer. Provide exact location to ensure that the image fills the projection screen and all necessary details in shop drawings.
- D. Provide all hardware as required for a complete mounting system, to include, but not be limited to, pipe extension columns, column accessories, and structural ceiling adaptors/mounts for suspension from structure above at suitable mounting height for proper alignment and imaging. Secure the projector to structure with anti-vibration mounts/devices at the location shown in the AV Drawings. Safety factor shall be at least five. Retain the services of a registered professional structural engineer licensed to practice in the State of installation to develop mounting details, including attachment to the building structure. Structural information shall include design calculations and a copy of engineer's certification.
- E. Verify factory color options for projector, mounting devices, and any required accessories with the Arch / Owner prior to ordering.
- F. Provide with input modules, if/as required per projector model, to satisfy the requirements and connectivity shown in the associated drawings.
- G. Projector models shall employ a laser-based light source.
- H. Based on throw distance, screen size, and required lens option, the supplied projection system shall provide approximately 75 foot-lamberts at the screen.
- I. Verify lens and screen photometrics in field prior to ordering.
- J. Furnish and install the following, or approved equal:
 - 1. Type VP at Auditorium: Epson EB-PU2216B 16K Lumen native WUXGA 3-chip LCD laser projector with ELPLL08 Long Zoom Lens. Provide Chief WMA2S Heavy Duty Dual Stud Wall Mount, VCMU Heavy Duty Universal Projector Mount, HBU Universal Interface Bracket, and 1.5" NPT Column Extension in length required. (Qty: 1 ea.)

2.17 PROJECTION SCREENS

- A. Furnish and install all projection screens in the areas as indicated. Verify locations with architect prior to installation. Refer to architectural drawings for exact locations.
- B. Install the projection screens only when clean and controlled environments are present.
- C. Each screen to have a flat tensioned viewing surface. Surface to be held taut and wrinkle free, eliminating edge curl. The viewing surface shall be seamless.
- D. All painting, metalwork, and woodwork shall be completed prior to installation, to protect against damage by other contractors.
- E. The screens shall be delivered to the job site, still in factory crating, while access is still available for screens of these dimensions. Store the screens in such a way as to protect them from moisture and adverse weather conditions. Take all precautions necessary to protect the screens from damage during storage and installation. Projection screens must remain in a climate-controlled environment at all times.
- F. Furnish and install the following, or approved equal:
 - 1. Auditorium Screen: Draper Ultimate Access XL V 226" Diagonal (120"H x 192"W) motorized projection screen in 16:10 aspect ratio with XT1000VB Matt White viewing surface, LVC-IV low-voltage interface, and black case. (Qty: 1 ea.)

2.18 FLAT PANEL DISPLAYS

- A. Furnish commercial flat panel displays and associated mounting devices at locations and in configurations indicated for use with the video distribution system.
- B. Coordinate with the Architect and Owner regarding exact locations and specific conditions.
- C. Provide all cabling and mounting device accessories associated with each display type. Coordinate mounting at all locations, to include surface-mount and wall-recessed conditions.
- D. Furnish specified devices at each and every location represented in the drawings.
- E. Furnish and install the following, or approved equal:
 - 1. Type TV-A: Samsung QM55C 55" 4K/UHD LED Display with Chief TS525TU Thinstall Full Swing Wall Mount. Provide Chief Hardware Kit for each unit supplied. (Qty: as shown.)
 - 2. Type TV-B: Samsung QM65C 65" 4K/UHD LED Display with Chief LTM1U Large Tilt Wall Mount. Provide Chief Hardware Kit for each unit supplied. (Qty: as shown.)
 - 3. Type TV-C: Samsung QM55C 55" 4K/UHD LED Display with Chief MTM1U Medium Tilt Wall Mount. Provide Chief Hardware Kit for each unit supplied. (Qty: as shown.)

2.19 NETWORK MEDIA ENCODING AND DECODING

- A. Furnish devices for use with encoding and decoding of Audiovisual signals over the dedicated AV-NET audiovisual data network. Devices shall support Gigabit Ethernet connectivity, and local DC or remote PoE+ power.
- B. Devices shall support up to, and including, 4K and UHD video resolution with ultra-low latency and visually lossless video. HDMI 2.0 and HDCP 2.2 shall be supported.
- C. System control shall be natively supported within the Audio DSP environment. Program Audio DSP system and associated touch control panel for individual encoder and decoder routing control to each endpoint location.
- D. Program associated audio routing within the specified Audio DSP system for each space via software Dante/Media Stream Receiver and Dante/Media Stream Transmitter devices.
- E. Furnish and install the following:
 - 1. Type CX-A Wall Plate Media Encoder: Visionary Solutions E5-WP-H-BLACK Wall Plate Encoder. (Qty: as shown)
 - 2. Type CX-B Wall Plate Media Encoders: Visionary Solutions E5-WP-BT-BLACK Wall Plate Encoder with Bluetooth audio. (Qty: as shown)
 - 3. Type CX-C Wall Plate Media Encoders: Visionary Solutions E5-WP-H-BLACK Wall Plate Encoder. (Qty: as shown)
 - 4. Encoder at DSK AV Equipment Desk: Visionary Solutions E5-WP-H-BLACK Wall Plate Encoder. Provide and install FSR SMWB-2G-BLK surface mount 2-gang box at side of DSK desktop for encoder mounting. (Qty: as shown)
 - 5. Media Encoders: Visionary Solutions E5100. (Qty: as shown)
 - 6. Media Decoders: Visionary Solutions D5100. (Qty: as shown)
 - 7. Rackmount Accessories: Provide Visionary Solutions AVIP-RACKMOUNT-3 rack kit, as required to support rackmount configurations shown. Provide AVIP-BLNK-1 blank covers at unpopulated spaces. (Qty: as required)
 - 8. NDI Decoder: Magewell Pro Convert NDI-to-HDMI 4k Decoder. Provide rackshelf and mount with other NDI encoding and conversion devices. (Qty: as shown)

2.20 VIDEO CAMERAS

- A. Furnish a pan/tilt/zoom video camera for use with local distribution of events in each applicable venue.
- B. Units shall provide simultaneous NDI and HDMI outputs. Devices shall be powered remotely via either PoE+ (IEEE802.af) or remote DC power supply.

- C. Each unit shall be supplied with manufacturer's wall mount or accessory housing, as specified.
- D. Furnish and install the following at the Auditorium, or approved equal:
 - 1. Type "CA" camera: Lumens VC-A61PN 4K NDI / HX PTZ Camera with VM12 Wall Mount. (Qty: as shown)

2.21 MICROPHONES, STANDS, CABLE, AND DIRECT BOXES

- A. Furnish microphones, stands, cables, and Direct Boxes for flexible use throughout the facility.
- B. Each microphone shall be equipped with its own cable, with Neutrik connectors installed on each end.
- C. Furnish the following at the Auditorium:
 - 1. PTT Paging Microphones: Telex NC450D noise-cancelling dynamic push-to-talk paging microphone. Terminate to Neutrik NC3MRX right-angle XLR-male plug and install at off-stage left WR AV wall rack. Replace factory clip with Magnetic Mic conversion kit (part# MMSU-1) for magnetic mounting at wall rack plate. (Qty: 1 ea.)
 - 2. Recording Microphones at Catwalk "M3" location: AKG C451B reference small diaphragm cardioid condenser microphone. Provide Wilkinson ORTF-CLIP for stereo recording, Ace Backstage #43 Mic Hanger Slug, and suspend as indicated in associated drawing package. (Qty: 2 ea.)
 - 3. Ambient Microphone at Catwalk "M3" location: Audix M1255B Mini Cardioid Condenser Microphone. Suspend as indicated in associated drawing package. (Qty: 1 ea.)
 - 4. Suspended choir microphones: Audix M1255B Mini Cardioid Condenser Microphone. Mount to theatrical battens, in a temporary fashion, for simple reconfiguration by the users as required by event. Provide 6ea. portable 100' black microphone cables. (Qty: 6 ea.)
 - 5. Crown/AKG PCC160 Phase-Coherent Cardioid boundary microphone. (Qty: 4 ea.)
 - 6. Shure SM58-LC Cardioid Dynamic Vocal Microphone. (Qty: 2 ea.)
 - 7. Shure SM57-LC Cardioid Dynamic Instrument Microphone. (Qty: 4 ea.)
 - 8. Shure SM81 Cardioid Condenser Instrument Microphone. (Qty: 2 ea.)
 - 9. Shure SM137 Cardioid Condenser Instrument Microphone. (Qty: 2 ea.)
 - 10. Sennheiser MD421-II Large Diaphragm Cardioid Dynamic Instrument Microphone. (Qty: 2 ea.)
 - 11. Atlas Sound DS-5E Desktop microphone stand, black. (Qty: 2 ea.)
 - 12. Atlas Sound MS20E heavy duty microphone stand, black. (Qty: 8 ea.)
 - 13. Atlas Sound PB21XEB adjustable boom with counterweight, black. (Qty: 4 ea.)
 - 14. Atlas Sound TB3664 tripod microphone stand with boom, black. (Qty: 4 ea.)
 - 15. Atlas Sound TB1930 short tripod microphone stand with boom, black. (Qty: 4 ea.)
 - 16. Whirlwind MKQ25NP-BLACK 25-foot microphone cable. (Qty: 6 ea.)
 - 17. Whirlwind MKQ50NP-BLACK 50-foot microphone cable. (Qty: 10 ea.)
 - 18. Whirlwind MKQ100NP-BLACK 100-foot microphone cable. (Qty: 6 ea.)
 - 19. Whirlwind L15 Leader 15-foot instrument cable. (Qty: 2 ea.)
 - 20. Radial Engineering JDI passive direct box with Jensen transformer. (Qty: 1 ea.)
 - 21. Radial Engineering PRO-AV2 passive stereo multimedia direct box. (Qty: 1 ea.)

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Furnish components, racks, wire, cabinetry, connectors, materials, parts, equipment and labor necessary for the complete installation of the systems, in full accordance with the recommendations of the equipment manufacturers and the requirements of the drawings and specifications.

- B. Installation shall follow standard broadcast wiring and installation practice, and shall meet or exceed industry standards for such work, with particular attention given to any installation instructions in Part 2 of these Specifications.
- C. Equipment shall be held firmly in place with proper types of mounting hardware. All equipment affixed to the building structure must be self-supporting with a safety factor of at least three. All equipment shall be installed so as to provide reasonable safety to the operator.
- D. All equipment shall be designed and rated for continuous operation and shall be UL listed, or manufactured to UL standards.
- E. Observe proper circuit polarity and loudspeaker wiring polarity. No cables shall be wired with a polarity reversal between connectors with respect to either end. Special care shall be taken when wiring microphone cables, to ensure that constant polarity is maintained. Balanced audio connectors shall be wired as follows:

WIRE	CONNECTOR	SIGNAL
BLACK	PIN#3 or RING	LOW or
RED or WHITE	PIN#2 or TIP	HIGH or
BARE	PIN#1 or SHIELD	GROUND

- F. Provide all audio circuits balanced and floating, except as noted in the Specifications or directed by the Consultant at the time of final equalization and testing. Shields of audio cables shall be grounded at one end only, at the inputs of the various equipment items in the system.
- G. Route cables and wiring within equipment racks and cabinetry according to function, separating wires of different signal levels (video, microphone level, line level, amplifier output, 120VAC, intercom, control, etc.) by as much physical distance as possible. Neatly arrange and bundle all cables loosely with plastic cable ties. Cables and wires shall be continuous lengths without splices.
- H. All system wire, except spare wire, after being cut and stripped, shall have the wire strands twisted back to their original lay and be terminated by approved soldered or mechanical means. No unterminated wire ends will be accepted. Heatshrink type tubing shall be used to insulate and dress the ends of all wire and cables. Include a separate tube for the ground or drain wire.
- I. All cables in conduits shall be insulated from each other and from the conduit the entire length and shall not be spliced. All cables and wires are to be continuous lengths without splices.
- J. All solder joints and terminations shall be made with resin-core silver solder.
- K. Temperature regulated soldering irons rated at least 60 watts shall be used for all soldering work. No soldering guns or temperature unregulated irons shall be used on the job site.
- L. Mechanical connections shall be made using approved connectors of the correct size and type for the connection. Wire nuts will not be accepted.
- M. Each mechanical connector shall be attached using the proper size controlled-duty-cycle ratcheting crimp tool which has been approved by the manufacturer of the connectors. Conventional non-ratcheting type crimping tools are unacceptable, and shall not be used on the job site.
- N. Label all wires in racks and console as to destination and purpose. Clearly and permanently label all jacks, controls, and connections, at the front and back of the rack, with permanent engraved laminated plastic labels or by engraving and filling mounting plates, unless otherwise noted. Attach laminated plastic labels with contact cement. Embossed or printed label tape, and press-on or lift-off lettering systems will not be accepted. All labeling shall be completed prior to final system inspection.

3.02 SOUND SYSTEMS FINAL TESTING AND EQUALIZATION

- A. The completed AV Systems shall be physically inspected by the Consultant to assure that all equipment is installed in a neat and professional manner, and in accordance with this Section. The AV Systems shall be tested by the Consultant, BAI, Austin, TX. Contact BAI at 512-476-3464 at least 4 weeks in advance of requested check-out dates for scheduling. Provide jobsite photos, confirming substantial completion of the AV Systems, to the Consultant for review when requesting check-out dates.
- B. The testing and equalization work shall be performed after the installation work has been completed, but prior to any use of the system.
- C. During the testing and equalization work, the Installer shall have on the job site one (1) competent technician who is familiar with the project, and who will be prepared to stay as long as his services are needed. It is estimated that approximately eight (8) hours will be required for this work.
- D. The process of equalizing and testing the system may necessitate moving and adjusting certain loudspeakers. Adjustments shall be performed without claim for additional payment.
- E. Coordinate as necessary to ensure a totally quiet room during the AV Systems testing and balancing period.
- F. Prior to requesting systems testing, verify the following:
 - 1. All systems are in first-class working condition and free of short circuits, ground loops, parasitic oscillations, excessive system noise beyond published specifications of the equipment, hum, RF interference, or instability of any form.
 - 2. All specified equipment is on the job site for proper accounting.
 - 3. All loudspeaker circuits have been tested, are connected to the proper crossover frequency, and are in perfect working order. Furnish impedance measurements of each circuit prior to final tests.
 - 4. All equipment controls are labeled, even if unused. If permanent labels cannot be furnished prior to system inspection, temporarily label every control as to its function with write-on tape. Supply labels or markers suitable for indicating knob settings after equalization is performed.
 - 5. Operation manuals for every equipment item furnished are on hand at the job site.
 - 6. Installer shall provide all signal processing software loaded on a portable PC and ready for use at time of testing. Installer shall provide a calibrated RTA and microphone, and pink noise generator at time of testing.
- G. Should the performance testing show that the Installer has not properly completed the systems, the Installer shall make all necessary corrections or adjustments and a second demonstration shall be arranged at the Installer's expense.
- H. The final acceptance of the system by the Owner will be based upon the report of the Consultant following inspection, testing, and demonstration. A list of items in need of completion or correction shall be generated by the Consultant, which must be corrected by the Installer before final acceptance will be granted.

3.03 SOUND SYSTEM PERFORMANCE

- A. After equalization and testing, the sound system shall meet or exceed the following specifications:
 - 1. System shall be free of short circuits, ground loops, parasitic oscillation, excessive system noise, hum, RF interference, and instability of any form.
 - 2. Maximum SPL with band-limited pink noise input to the system shall be:
 - a. Auditorium: Maximum SPL with band-limited pink noise / program material input to the system shall be 93 dB before audible distortion occurs, spatial variation +/- 3dB at 4kHz, frequency response uniform to +/- 2 dB, 32 Hz to 16 kHz.

3.04 OWNER TRAINING AND FAMILIARIZATION

- A. The Installer shall furnish the Owner's representatives with training necessary to properly operate the systems. Demonstrate in detail all functions of the systems. Provide a minimum of eight (8) hours of instruction and familiarization for this purpose. These training sessions shall be videotaped by the Installer and copies provided to the Owner with the as-built documentation.
- B. The Installer shall attend one scheduled event, as selected by the Owner, to assist and troubleshoot, as necessary, in initial user operation of these systems.
- C. The training phase shall be accompanied by complete as-built documentation and the custom technical systems operation manual, as described in Part 1.09 of this Specification Section.

END OF SECTION

SECTION 27 41 16.20
LOCAL SOUND REINFORCEMENT SYSTEMS

PART 1 – GENERAL

1.1 RELATED WORK

- A. The following sections shall associate with this specification as applicable.
1. General Conditions
 2. Supplementary Conditions
 3. Division 1
 4. Division 26 in its entirety.
 5. Division 27 in its entirety.
 6. Division 28 in its entirety.

1.2 DESCRIPTION

- A. Summary of Work:
1. Provide all equipment specified well as all miscellaneous parts and materials required for the proper, complete, and functional Video and/or Sound Distribution System at the following Venues:
 - a. Press boxes as shown on drawings.
 2. All applicable equipment shall bear the UL label.
 3. Governing Codes and Conflicts: If the requirements of these specifications or the Project Drawings exceed those of the governing codes and regulations, then the requirements of these specifications and the Drawings shall govern. However, nothing in the Drawings or Specifications shall be construed to permit work not conforming to all governing codes, regulations, and manufacturer installation requirements.
 4. Locate equipment to accommodate millwork, fixtures, marker boards and other room equipment at no additional cost to the owner.
 5. Plenum rated cable may be used as an option at the contractor's discretion. Wherever cabling is run exposed, conduit shall be used to cover and protect wiring.
 6. These documents are conceptual in nature. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer's shop drawings and product data submittals shall represent a complete system and documents accepted do not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project's Technology Consultant and the Owner.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications:
1. The contractor providing and installing the integrated audiovisual systems and associated infrastructure shall be an authorized dealer of the specified projector manufacturer and be capable of providing the manufacturer's maximum available product warranty.
 2. All individuals installing the audio-video system must be employees of the authorized dealer and at least 75% of the installing staff shall have undergone a training class given by the manufacturer. Current certification indicating the successful completion of the training course shall be available upon request at the project and submitted in the contractor's product submittals.
 3. The proposing contractor and the installing contractor must be the same company. No subcontractor to the proposing audio-video contractor will be

4. allowed for any portion of the audio-video scope of work.
 4. The System Installer shall meet all applicable regulations of the State and Department of Labor insofar as they apply to this type of system. The bidder shall be a firm normally employed in the audio-video industry and shall provide a reference list of ten (10) projects of equivalent size or larger and contact names confirming successful completion of projection system installations.
 5. The bidder shall have an authorized service center, within 75-miles of the project's location, for the brand of equipment that is submitted for bid. The Owner, Architect, and Consultant reserves the right to perform an onsite inspection as they deem necessary.
 6. The bidder must produce a letter from the manufacturer guaranteeing the delivery of all the equipment outlined in the specification herein.
 7. The bidder shall have a full-time local service personnel capable of servicing the projector system described herein.
- B. Pre-Construction Meeting:
1. The successful Contractor shall attend a mandatory pre-construction meeting with individuals deemed necessary by the Owner's representative prior to the start of the work.
 2. The contractor shall provide a mockup of the complete integrated audiovisual system solution for each of the typical spaces below before implanting the installation in multiple like rooms. Mockup shall include all products listed in part 2 of this specification. Coordinate with G.C., Architect, Consultant, and Owner for scheduling and location of mockup.
 3. All proposing contractors must have ability to demonstrate a/v system being proposed and provide owner with completely installed system to evaluate performance and operation.
- C. Acceptance: The Owner's representative reserves the right to reject all, or a portion of the work performed, either on technical or aesthetic grounds.
- D. Warranty:
1. The selected system installer shall be factory authorized service center and shall provide an end-to-end performance warranty of not less than one (1) year. The proposer shall provide current certification documentation. The performance warranty shall be issued by the manufacturer and shall warrant that video projection system projectors have been tested to the district's approval. This end-to-end warranty shall cover the labor associated with removing/reinstalling any associated hardware or equipment as well as the replacement of all defective equipment or hardware.
 2. The bidder shall also submit with the materials mentioned in section 1.5 submittals of this specification a written explanation outlining the terms and conditions of product warranty of all parts and service of the integrated a/v solutions.

1.4 REGULATORY REQUIREMENTS

- A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
1. Latest Local Codes and Amendments
 2. National Electrical Code, current version
- B. Other References:
1. TIA/EIA-568-A Commercial Building Telecommunications Wiring Standard
 2. EIA/TIA-569 Commercial Building Standard for Telecommunication Pathways and Spaces.
 3. TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.

4. TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications.
 5. EIA/TIA 455-A Standard Test Procedure for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices and Other Fiber Optic Components.
 6. TIA/EIA TSB 67 Transmission Performance Specification for Field Testing of Unshielded Twisted-Pair Cabling Systems.
 7. TIA/EIA TSB 72 Centralized Optical Fiber Cabling Guidelines
 8. ISO/IEC 1180 Generic Cabling Standard
 9. EN 50173 Generic Cabling Standards for Customer Premises
 10. ANSI/EIA/TIA 526-14 Optical Power Loss Measurements of Installed Multimode Fiber Cable Plan.
- C. Governing Codes and Conflicts: If the requirements of these specifications or the Project Drawings exceed those of the governing codes and regulations, then the requirements of these specifications and the Drawings shall govern. However, nothing in the Drawings or Specifications shall be construed to permit work not conforming to all governing codes and regulations.

1.5 ABBREVIATIONS

- A. The following abbreviations are used in this document:
1. AV-# Audiovisual input station / Presentation Station (Reference drawing legend) CMP Ceiling Mounted Projector LCD or LED Flat panel screen/monitor

1.6 SUBMITTALS

- A. Project Initiation: Within fourteen (14) days of Notice to Proceed, the projection system installer shall furnish the following in a single consolidated submittal:
1. Permits: The Contractor shall obtain all required permits and provide copies to the Owner/Architect/Engineer.
 2. Product Literature: Complete manufacturer's product literature for all, speakers, amplifiers, cable, cross-connect blocks, cable supports, cable labels, outlet devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner/Designer) and the manufacturer's supporting documentation demonstrating compatibility with other related products shall be included.
 3. Construction Schedule: A time-scaled Construction Schedule, using PERT/CPM, indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
 4. Testing: Proposed Contractor test result forms, and a list of instrumentation to be used for systems testing.
 5. The contractor shall provide a letter from the manufacturer stating that the dealer is an authorized service center.
 6. The resume and contact information of the full-time service personnel responsible for the installed projection system.
 7. Specification Compliance: A letter shall be provided stating, by section and subsection, that the installer complies with the ENTIRE specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been accepted by the project's technology consultant.
 8. Certifications: The contractor shall submit all of the following certifications and the certifications must contain dates which are valid from the date of proposal and not expire any sooner than 12 months after substantial completion of the project.

- a. AMX authorized dealer certification
 - b. Installer training certification: 1) Provide specification with line-by-line acknowledgement of compliance.
- B. Shop Drawings: Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
1. Proposed wiring and connectivity diagram of the proposed projection system including all faceplates and sound reinforcing equipment
 2. In addition to the wiring/connectivity diagram, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:
 - a. Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)
 - b. Location of sleeved wall pass-thru
 - c. Size of sleeve at each location installed
 - d. Quantity of cable passing through each sleeve
 - e. Location of drops in each room (quantity or labeling of drops are not required in the submittal plans. Labeling shall be provided in the closeout plans and quantities shall be as per the contract documents, addendums, and issued changes. Each drop shall be labeled for the type of outlet that it is)
 - f. Conduit routing, size, quantity, and stub-up locations for all floor mounted outlets.
 3. Drawing Compliance: A letter shall be provided stating that the installer complies with the ENTIRE project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. NO DEVIATIONS SHALL BE ACCEPTABLE UNTIL THEY HAVE BEEN ACCEPTED BY THE PROJECT'S TECHNOLOGY CONSULTANT.
- C. Project Completion: As a condition for project acceptance, the Contractor shall submit the following for review and approval:
1. Samples: Complete manufacturer's product literature and samples (if requested) for all pre-approved substitutions to the recommended products made during the course of the Project.
 2. Inspection and Test Reports: During the course of the project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed conform to Contract requirements. The contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
 3. Operating and Maintenance Instructions: Operating and maintenance instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction and shall be provided to the Owner for their use on disc or USB drive with the project name and description (2 copies).
 4. Provide schematic line diagram of system components as deployed in each installation.

PART 2 – PRODUCTS

2.1 GENERAL

All products listed in this section shall be provided and installed by the contractor unless otherwise noted below. The following list is not intended to be a complete list of required equipment or cables as the project is to be Turnkey and may require equipment beyond the depth

of this list. It is the contractor's responsibility to ensure that they are providing a complete and functional system with their proposal.

- A. Installation: The cabling shall be installed per requirements of the manufacturer and the Project Documents utilizing materials meeting all applicable TIA/EIA standards. The Contractor is responsible for providing all incidental and/or miscellaneous hardware not explicitly specified below as required for a complete and operational system.
- B. Materials: Materials shall be as listed or shall be approved equivalent products of other manufacturers meeting the intent and quality level of the TIA/EIA specifications. All approved equivalent products will be published by addendum ten days prior to proposal for Architect / Engineer to review.
- C. Testing: All installed cabling shall be tested 100% good after installation by the Contractor.
- D. Ratings: All products shall be new and brought to the job site in the original manufacturer's packaging. Electrical components (including innerduct) shall bear the Underwriter's Laboratories label. All communications cable shall bear flammability testing ratings as follows:
 - CM Communications Cable
 - CMP Plenum Rated Communications Cable
 - CMR Riser-Rated Communications Cable
- E. Initial Cable Inspection: The Contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of the proper gauge, containing the correct number of pairs, etc. Note any buckling of the jacket that would indicate possible problems. Damaged cable or any other components failing to meet specifications shall not be used in the installation.
- F. Cable Lubricants: Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit.
 - 1. Approved Products
 - a. Twisted-pair cable: Dyna-Blue
 - b/ American Polywater
- G. Fire Wall Sealant: Any penetration through firewalls (including those in sleeves) will be resealed with an Underwriter Laboratories (UL) approved sealant.
 - 1. Approved Products
 - a. 3M or
 - b. Pre-approved equal

2.2 TRAINING

- A. A minimum of eight hours for instruction in proper operation and routine maintenance of the system. Instruction shall cover all materials indicated in the Owner's operations manual.
- B. Operational guidelines shall be given in written form in sufficient numbers so that all key personnel have operational instructions of programming; station use and special features. Copies of these instructions shall be provided for permanent record in the operations and maintenance manuals.

2.3 WARRANTY

- A. One year from Date of Substantial Completion

2.4 PRODUCTS AND MATERIALS

- A. Athletic Field P.A. Systems(Press Boxes):
 - 1. Amplifier: QSC 4-channel PLD 4.2 or similar product
 - 2. Rack: Middle Atlantic DTRK-718 or similar product
 - 3. Mixer: Art MX622 or similar product

4. Wireless Microphones: Two (2) Shure QLX/ULX wireless mics
5. Exterior mounted speakers- JBL AWC 129 BK
 - a. Mount speakers on front of press box: two speakers on each side, mounted horizontally one over the other. Speakers must be mounted to move left and right horizontally.
6. Wall mounted equipment (in the knee space in center of press box)
 - a. One Mic Jack Plate
 - b. One L-R Aux input plate (2 RCA audio jacks)

PART 3 – EXECUTION

3.1 GENERAL

- A. Contractor is required to properly mount integrated A/V solutions and connect all ceiling video / audio cables to projector component inputs.
- B. Contractor is required to thoroughly test and verify operation of all A/V inputs and video modes prior to project completion.
- C. Contractor is required to focus and adjust projector to properly project image on viewing surface (screen or multimedia board depending on location).
- D. Contractor shall provide owner with written verification test process and results once all projectors have been installed, tested, and placed in final condition.
- E. Damage: The Contractor shall replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over tightened bindings, loosely twisted and over-twisted pairs at terminals and cable sheath removed too far (over 1-1/2 inches).
- F. The Contractor shall replace any damaged ceiling tiles that are broken during cable installation.
- G. Clean Up: All clean up activity related to work performed will be the responsibility of the Contractor and must be completed daily before leaving the facility.

3.2 DOCUMENTATION

- A. Contractor shall provide owner with detailed serial number listing and associated graphical room number designation equipment was installed. Contractor shall use actual graphical package room numbers not architectural plan numbers from construction set.

3.3 STATION WIRING INSTALLATION

- A. General: All cable must be handled with care during installation so as not to change performance specifications. Factory twists of each individual pair must be maintained up to the connection points at both ends of all category 6 cable. There shall never be more than one and one-quarter inch of unsheathed enhanced Category6 UTP cable at either the wiring USB Transmitter or Receiver.
- B. Exposed Cable: All cabling shall be installed inside walls or ceiling spaces whenever possible. Exposed station cable will only be run where indicated on the Drawings. Additional exposed cable runs will require Owner approval and will only be allowed when no other options exist.
- C. Placement: All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the Owner's efficient use of their full capacity.
- D. Cable Routes:
 1. All cabling placed in ceiling areas must be in conduit, cable tray or an approved J-Hook cable support. Cable supports shall be permanently anchored to building structure or substrates. Provide attachment hardware and anchors designed for the structure to which attached and that are suitably sized to carry the weight of the cables to be supported. Do not route cable through webbing of structural steel. Cabling must be supported in dedicated supports intended to support

- cabling as described in this section. Contractor shall adhere to the manufacturer's suggested fill ratio for each size cable support installed.
2. Attaching cable to pipes or other mechanical items is not permitted. Communications cable shall be rerouted so as to provide a minimum of 18 inches spacing from light fixtures, sources of heat, power feeder conduits and EMI sources. Cabling shall not be attached to ceiling. Grid support wires. Cable runs shall be routed down the corridors; parallel or perpendicular to building structure. Multiple cables to be bundled together at and between each cable support installed.
 3. Contractor shall be responsible for coordinating with other trades on the project so that the installed cable pathway does not interfere with the installation of other systems to ensure that mechanical ducts, pipes, conduits, or any other above ceiling systems are not putting unnecessary stress on any portion of the install audio-video cabling.

3.4 STATION HARDWARE

- A. Flush mounted components: all components shall be inserted to a flush mounted faceplate unless designated otherwise.
- B. Placement: Where possible, the AV input outlets shall be located so that its centerline is 18 inches above floor level or 12 inches above permanent bench surfaces. Outlets shall not be mounted on temporary, movable, or removable surfaces, doors, or access hatches. The CMP outlet shall route directly to the rear of the projector and does not require any type of faceplates.

3.5 PROGRAMMING

- A. Programming shall be coordinated with the Owner and Project's Consultant. Programming shall include, but not be limited to the following:
 1. AV Control Panel Configuration
 2. Audio routing from any source location through the DSP
 3. Projector and screen control via the Audio / Video Control panel
 4. Device resolution and over/under-scanning settings
 5. Incorporation of any Owner furnished source equipment (maximum of 3)

3.6 FINAL TESTING REQUIREMENTS

- A. Notification: The Owner and Engineer shall be notified one week prior to any testing so that the testing may be witnessed.
- B. Inspection: Before requesting a final inspection, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms and timetable for all copper and fiber optic cabling.
- C. Procedures: Trained personnel shall perform all testing. Acceptance of the test procedures discussed below is predicated on the Contractor's use of the recommended products and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation will be evaluated in the context of each of these factors. Testing procedures shall consist of, but not be limited to the following:
 1. Input locations to be tested utilizing multiple types of source equipment.
Equipment to include:
 - a. Personal Computer (laptop)
 - b. Apple iMac
 - c. Apple Mac Mini
 - d. Google Chromebook
 - e. Additional devices may be required at the time of testing
 - f. contractor to provide devices on a single cart, to roll between inputs

- 2. Routing of video, from any source to each projector and display simultaneously and independently.
- 3. Routing of audio, from any source to each audio channel simultaneously and independently.
- 4. Control of the entire system from each installed A/V Control Panel
- 5. Additional test requirements may be required at the Owner and/or Consultant's request.

3.7 OWNER TRAINING AND DEMO

- A. A/V integrator shall provide demonstration of all integrated a/v solutions to owner's staff that have any stake with the operation and maintenance of the a/v solutions. Integrator shall produce sign in sheets for record of who was trained and when. Copies of sign in sheets shall be submitted with close out paperwork. Coordinate training dates with owner at project completion.
- B. Integrator shall provide factory training for owner's operations and maintenance personnel for each major component of the systems listed in the A/V solutions outlined in part 2 of these specifications. Training shall be a minimum of 4 hrs. per person. Re-training of staff shall be available, at no cost to the owner, to a maximum of 3 on-site training sessions up to 1 year from the date of project completion.
- C. All training is to be recorded via video recording and a copy of the recorded video shall be provided to the owner upon completion. All video recording equipment, for the recording of training, shall be provided by the integrator.

END OF SECTION

**SECTION 27 5000
SCHOOL COMMUNICATION SYSTEM**

PART 1 - GENERAL

1.1 RELATED WORK

The following, in their entirety and as applicable, shall apply to this section. Including any associated drawings.

- A. Conditions of the Contract
- B. Division 1
- C. Division 26
- D. Division 27
- E. Division 28

1.2 SUMMARY

- A. This section includes a fully operational IP platform for a district-wide internal and school Critical Communications Solution, incorporating school safety notifications and general communications including but not limited to the following:
 - 1. The platform shall provide complete internal communications and employ state of the art IP Technology including the minimum functions listed.
 - a. Two-way internal intercommunications between staff locations and classrooms.
 - b. Scheduled bell events.
 - c. Emergency announcements that will override any pre-programmed audio, assuring that all Emergency/Lockdown etc., are heard at each and every speaker location.
 - d. Capability of prerecording emergency announcements that can be activated by a Soft Key on an administrative console, panic button, dial string, or web browser.
 - e. Atomic Time Synchronization with Class Change Tones utilizing multiple, programmable schedules for each zone.
 - f. District-wide, Emergency, Group, All School and Zone live voice paging.
 - g. District-wide, Emergency, Group, All School and Zone paging for pre-recorded audio – tones, music, and voice.
 - h. Web-based user interface.
 - 2. The system shall support a minimum of 1000 level priorities which shall be user-definable, allowing each end point to place a minimum of 5 different priority calls at the same time.
 - 3. Any authorized administrator shall be able to call from outside the school into any classroom, zone, or entire school directly via the School District supplied SIP enabled Telephone Network. This shall allow remote monitoring, call-in annunciation, and two-way conversation from outside the facility as well as paging into the system. (Compliance with NEMA Standard SB-40 for emergency communications in K-12 Schools).
 - 4. Authorized system users shall be able to create a minimum of 100 automated sequences with voice instructions, tones, emails, program distribution, and relay activations and replay them.
 - 5. Automated message strings shall be manually initiated from a single-button access on the console, on a SIP connected telephone, a panic button, from the web-based user interface or via interface with third party systems.
 - 6. Paging and two-way intercom features shall be accessible from any system console or SIP connected telephone for each campus.
 - 7. The platform shall synchronize its system time to the network timeserver or a

- 8. web-based time server.
- 9. Each single campus installation shall be locally survivable for intercom, paging, bells, and emergencies such as lockdown, even when the district connection is unavailable.
- 10. This specification establishes a minimum level of quality, features, and performance for individual components as well as the integrated system.
- 11. Systems that do not comply with the feature-sets highlighted in this Specification will not be considered.
- B. Locate equipment to accommodate millwork, fixtures, marker boards and other room equipment at no additional cost to the Owner.
- C. Integrate the communications system with the following systems:
 - 1. Clock and Bell System
 - 2. Local sound reinforcement sound systems
- D. Return air plenum cable shall be used. Wherever cabling is run exposed, conduit shall be used to cover and protect wiring.
- E. The drawings and specifications are to be considered conceptual in nature and are intended to establish system standards insofar as manufacturer type and system configuration. The contractor shall provide pricing of a complete engineered system based on the issued conceptual documentation. The engineered system is to be submitted to the project's consultant for review prior to installation.
- G. If there are any discrepancies between the drawings and specification or among themselves, the contractor shall request clarification prior to providing pricing for the scope of work. If a request is not issued and a response not provided via a posted addendum, the contractor shall provide pricing for the costliest scenario and obtain clarification during the project.

1.3 DEFINITION OF TERMS

- A. Installer(s): Shall refer to the person, persons, or company who or which actually contracts to perform the work specified herein.

1.4 SUBMITTALS

- A. Product data for each component.
- B. Shop Drawings: Prior to proceeding with the work: Provide detailed equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, location of each field connection, and a complete schedule of all equipment and materials with associated manufacturer's cuts sheets which are to be used.
 - 1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring. Identify terminals to facilitate installation, operation, and maintenance. Include a single-line diagram showing cabling interconnection of components and levels throughout system and impedances.
 - 2. Artwork drawings and lists indicating proposed nameplate nomenclature and arrangements for control panels and plug panels prior to fabrication reflecting equipment used.
 - 3. Each drawing shall have a descriptive title and all sub-parts of each drawing shall be labeled. All drawings shall have the name and locations of the project, Systems Contractor's name in the title block.
 - 4. Details and descriptions of any other aspect of the system, which must differ from the contract documents due to field conditions or equipment, furnished.
- C. FCC Approval: The system shall be approved for direct interconnection to the telephone utility under Part 68 of FCC rules and regulations. Systems, which are not FCC approved

- or utilize an intermediary device for connection, will not be considered. Provide the FCC registration number of the system being proposed as part of the submittal process.
- D. Product Certificates: Signed by manufacturers certifying that products furnished comply with specified requirements.
 - E. Installer Certificates: Signed by manufacturers certifying that Installers comply with specified requirements.
 - F. Manufacturer Certificates: Signed by manufacturers certifying that they comply with specified requirements.
 - G. Field Test Reports: Indicate and interpret test results for compliance with performance requirements. Include record of final matching transformer-tap settings, and signal ground-resistance measurement certified by Installer.
 - H. Maintenance Data: For equipment to be included in maintenance manuals specified in Division 1.
 - 1. Record of Owners equipment-programming option decisions.
 - 2. All instructions necessary for proper operation and manufacturer's instructions.
 - 3. "Proof of Performance" information.
 - 4. Manufacturer's maintenance information.
 - 5. Copies of non-proprietary computer programs and system set up disks documenting all programmable features of the installed system.
 - I. Record Drawings: Prior to final acceptance, provide three (3) complete sets of drawings indicating all cable numbers and construction details in accordance with the actual system installation. Revise all shop drawings to represent actual installation conditions. These Record Drawings will be used during "Final Acceptance Testing".
 - J. System Training: Submit the following information describing the training programs and system trainers as outlined in paragraph 1.6 of this specification and in accordance with Division 1 specifications.
 - 1. Include with the submittal a preliminary staff development training program in outline form for review and approval by the owner's representative.
 - 2. Include with the submittal a current copy of the trainer's certification from the manufacturer that certifies and identifies the trainer(s) who are eligible to provide training and support for the project.
 - 3. Include with the submittal a current copy of trainer's needs assessment form which will be reviewed with the owner's designated representative for the system's preliminary system programming and configuration.
 - 4. Include with the submittal copies of all documentation used to identify for the owner those participants attending and completing the training programs.
 - K. A copy of the manufacturer's standard statement of warranty proving all equipment provided for the school communications network is covered with the required five-year warranty shall be included with the project submittal. This statement of warranty shall be provided on the manufacturer's stationary.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced Installer who is an authorized representative of equipment manufacturer for both installation and maintenance of equipment required for this Section. Provide the following within thirty (30) days after notification to proceed:
 - 1. Provide a list of installations that the Installer has specifically installed for verification by the Owner. Random installations from other vendors and/or Installers shall not be accepted. The Installer, not its employees, must meet these qualifications.
 - 2. The Installer shall be bondable.
 - 3. The Installer shall demonstrate to the satisfaction of the Owner or his representative that he has:
 - a. Adequate plant and equipment to pursue the work properly and

- expeditiously.
 - b. Adequate staff and technical experience to implement the work.
 - c. Suitable financial status to meet the obligations of the work.
 - d. Technically capable and factory trained service personnel at a local service facility to provide routine and emergency service for all products used in this project.
- B. Because the life expectancy of this type of communications structure normally exceeds 10 years, the owner expects continuity from the service provider. If the installing/servicing company has not been an authorized provider of the manufacturer's product for it least seven (7) years, the following is required:
 - 1. A list of two (2) systems manufacturers of which they currently are authorized service providers where the relationship exceeds seven (7) years.
 - 2. A letter from the manufacturer outlining the details of changes in service providers over the last seven (7) years and what actions they will take to ensure continuity of service to the customer.
- C. Each major component of equipment shall have the manufacturers name, address and model number on a plate securely affixed in a conspicuous place. NEMA code ratings, UL Label, or other data that is die-stamped into the surface of the equipment shall be easily visible.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- E. Comply with NFPA 70
- F. Comply with NEMA Standard SB-40 for Emergency Communications in K-12 schools.
- G. Comply with UL 60950.

1.6 SUBMITTALS

- A. Project Initiation:
 - 1. Within fourteen (14) days of Notice to Proceed, the projection system installer shall furnish the following in a single consolidated submittal:
 - a. Product Literature: Complete manufacturer's product literature for all, speakers, amplifiers, cable, cross-connect blocks, cable supports, cable labels, outlet devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner/Designer) and the manufacturer's supporting documentation demonstrating compatibility with other related products shall be included.
 - b. Construction Schedule: A time-scaled Construction Schedule indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
 - c. The contractor shall provide a letter from the manufacturer stating that the dealer is an authorized service center.
 - d. The resume and contact information of the full-time service personnel responsible for the installed projection system.
 - e. Specification Compliance: A letter shall be provided stating, by section and subsection, that the installer complies with the entire specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been accepted by the project's technology consultant.
 - f. Certifications: The contractor shall submit all of the following certifications, and the certifications must contain dates which are valid from the date of proposal and not expire any sooner than 12 months

- after substantial completion of the project.
 - 1) State Licenses as applicable to this system
 - 2) Manufacturer's Authorized Dealer Certification
 - 3) Manufacture Installer Training Certificate (required for at least 25% of all installers on site.)
 - g. Provide specification with line-by-line acknowledgement of compliance.
- B. Shop Drawings:
- 1. Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
 - a. Proposed wiring and connectivity diagram of the proposed projection system including all faceplates and sound reinforcing equipment
 - b. In addition to the wiring/connectivity diagram, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:
 - 1) Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)
 - 2) Location of sleeved wall pass-thru
 - 3) Size of sleeve at each location installed
 - 4) Quantity of cable passing through each sleeve
 - 5) Location of drops in each room (quantity or labeling of drops are not required in the submittal plans. Labeling shall be provided in the closeout plans and quantities shall be as per the contract documents, addendums, and issued changes. Each drop shall be labeled for the type of outlet that it is)
 - 6) Conduit routing, size, quantity, and stub-up locations for all floor mounted outlets.
 - c. Drawing Compliance: A letter shall be provided stating that the installer complies with the ENTIRE project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been accepted by the project's technology consultant.

1.7 IN-SERVICE TRAINING

- A. The contractor shall provide and implement a complete and comprehensive staff training program for all administrators, facility staff members, and teachers. This mandatory training program will provide school staff a complete understanding of how to utilize and properly operate all functions.
- B. The training program shall be implemented by a staff member/trainer employed by the contractor. The trainer must be factory certified to provide training on their product.
- C. All staff development training is to be coordinated through the owner's designated representative. As training sessions are completed, the trainer will provide the school's administrative staff and school district's staff a document listing all the staff and faculty members who attended, received, and completed the training program.

1.8 WARRANTY

- A. Provide a manufacturer's five-year warranty of the school communications network equipment against defects in material and workmanship. This warranty will cover all electronic system components. Additional warranties cover clocks, speakers, and call-in switches. If any defects are found within the warranty period, the defective equipment shall be replaced at no cost (equipment only); a one-year warranty shall be provided for labor.

- B. A copy of the manufacturer's standard statement of warranty proving all equipment provided for the school communications network is covered with the required five-year warranty shall be included with the project submittal. This statement of warranty shall be provided on the manufacturer's stationary. The standard five-year warranty is an important element in establishing a standard in quality. Manufacturers who circumvent the five-year warranty by offering special "extended warranties" that are not part of their normal published warranty will not be accepted.
- C. Contractor shall respond, excluding weekends and holidays, within 24 hours to any warranty service calls. If equipment cannot be repaired within 24 hours of service visit, the contractor shall provide "loaner" equipment to the facility at no charge.
- D. Make available a service contract offering continuing factory authorized service of the system after the initial warranty period.

1.9 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide the following system:
 - 1. Telecenter U as manufactured by Rauland and installed by a Rauland authorized dealer

PART 2 - PRODUCTS

2.1 SYSTEM REQUIREMENTS

- A. The New Campus Communications System will connect to the Existing District Server for District Wide announcements and all Management Functions. Server Currently Runs the Rauland Telecenter Campus Enterprise Software.
- B. The platform shall utilize state of the art IP Technology for Call-in Notification, School Safety Paging and Evacuation tones, Atomic Time Synchronization, Class Change Tones utilizing multiple, programmable schedules for each zone, Two-way hands-free Internal Communications and Paging, and Program Distribution. The system shall be easy to learn and operate. All standard programming shall be web-based and user friendly to allow the system administrator the ability to easily program system features.
- C. Provide complete and satisfactorily operating district/school communications and district/school safety as described herein, using materials and equipment of types, sizes, ratings, and performances as indicated. Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction, in accordance with published product information. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions.
- D. The platform shall be a single electronic system consisting of a minimum of 10 audio channels for each campus, (classroom) IP Speaker Modules and call switches, IP Zone Modules connecting corridor speakers, inside and outside horns, IP Administrative Consoles, SIP enabled PBX integration and district-wide integration for paging, emergency notifications, calendar scheduling and configuration.
- E. Each Classroom shall be provided with a Speaker Module interface and a minimum of 5 different call switches, each with their own annunciation path and priority.
- F. Call-ins may automatically annunciate (display of priority and location) to administrative consoles, SIP enabled phones, and outside phones.
- G. Call-ins shall be programmed to automatically change priority and annunciation route based on age of call-in and original priority.
- H. Call-ins may have priority (and annunciation route) changed by user action from a console or SIP enabled phone.
- I. Call-in annunciation route shall include playing pre-recorded audio over speakers, sending a pre-configured email, and activating relays.
- J. The platform shall lend itself to expansion by simple addition of hardware modules.
- K. The platform shall connect directly to an existing, standard protocol WAN/LAN network,

- without the need for a separate server at each school location. Configuration, including bell schedules, calendars, and emergency sequences can be remotely created, changed, stored, and downloaded to the system by an authorized user from a web-based user interface.
- L. The platform shall provide the ability to initiate school safety paging announcements, evacuation tones and take cover tones from any telephone or connected web browser within the facility or outside the facility to any other location within the facility or district.
 - M. The platform shall provide the ability to selectively communicate or monitor individual classrooms in emergency situations from any telephone within the facility or outside the facility to any other location within the facility; all communication within the classroom shall be hands-free and will not require any interaction by the classroom user.
 - N. The platform shall provide classroom users the ability to confirm that they have safely secured their classrooms during an emergency with a single button press. The front office administrator will receive confirmation that the classroom is safely secured via an administrative console and web-based user interface. The front office administrator can view classrooms that are not safely secured via the administrative console. The front office administrator can view classrooms that are not safely secured via the web-based user interface. The front office administrator shall be able to initiate two-way communication, without a pre-announcement tone, to the classroom during an emergency via the administrative console. Web-based user interface will still identify that a school is in an emergency, even if all classrooms are safely secured. Individual classroom check-in and school emergency status shall be viewed from the web-based user interface, both on-site and remotely.
 - O. IP Addressable and POE powered Speaker Modules for individual rooms shall be system programmable and may be assigned any two, three, four, five- or six-digit number as well as name and description. Any extension may be reassigned at any time.
 - P. IP-enabled two-way voice communication shall be available from any provided telephone or administrative console through any speaker in a campus. This shall allow hands-free communication to any classroom or any individual loudspeaker unit. A programmable pre-announce tone shall sound immediately before the intercom path is opened and a supervisory tone shall continue to sound at regular intervals when speaker monitoring is active, complying fully with all privacy legislation. Preannounce tone and supervisory tones shall be disabled during designated emergencies automatically.
 - Q. The platform shall allow users to configure multiple schedules per school, with a minimum of 500 unique events per schedule, and automatic Daylight Savings time correction. Schedules can be programmed to occur once, daily, weekly, monthly, or in any combination of the preceding recurrences. Each school may have a minimum of 20 unique bell schedules, with a minimum of 5 active schedules on any given day for each campus. User shall be able to select from 25 standard included tones as well additional user created and uploaded audio files for class change signaling and messaging. In addition, scheduled events shall include relay actions, email notifications, and paging exclusions as system configuration changes. The platform shall allow control of the bell schedules via the district WAN/LAN without the need for a separate server at each school location. Bell schedules can be remotely created, changed, stored, and assigned to calendar days for the local school by an authorized user from a web-based user interface.
 - R. The platform shall be able to integrate with an existing PA system or operate as a fully independent IP solution. The platform shall be able to function in combination of said configurations and allow for seamless communication within a school or district-wide, regardless of the type of configuration used. The platform shall be scalable, with the ability to easily add, install, and configure additional equipment to a system.
 - S. The platform allows for customization of preprogrammed sequences, used for

emergencies, events, and everyday communications. Preprogrammed sequences can be activated from the push of a relay button, soft key of an administrative console, a dial string of a SIP phone, or a web browser configured to the district network. Sequences can be initiated automatically as part of a schedule or on the fly. Preprogrammed sequences can be customized to utilize any combination of audio tones, emails, relays, tone exclusions, swings, delays, duples, SIP phone notifications, and program distribution. Audio tones can include customized audio files and voice messages, recorded in any language. Uploaded audio tones and messages can be preprogrammed to annunciate repeatedly or individually, as part of a scheduled sequence or on the fly. Each school in a district can have its own customized sequences, and can be activated individually, in groups, or districtwide.

T. Reference attachment 'A' for more information.

2.2 EQUIPMENT AND MATERIAL

A. Server Software

1. Provides district-wide paging, bell event scheduling, emergency notification and configuration for entire district.
2. Ability to configure system and initiate system features, per school and district-wide via web-based user interface.
3. The software has the ability to sync system time to the Atomic Clock Signal or to the school's or district's network time server.
4. The software will provide a web browser to deliver district-wide emergency paging, pre-recorded messages, and tones from any authorized computer in the facility or the district. The software must be capable of automatically notifying district personnel via the WAN/LAN of an alarm condition.
5. The software can automatically broadcast emergency instructions via associated system hardware throughout an entire district when an alarm (e.g., lockdown, lockout, security, fire) is initiated via the web-based user interface. The emergency instructions are preprogrammed and require no user intervention. Bell tones can be halted during an emergency. The system provides redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.
6. The software allows for user-uploaded pre-recorded messages and tones. Software supports the upload of MP3 and WAV file types. User-uploaded pre-recorded messages and tones can be part of emergencies, sequences, and bell schedules.
7. The software can be installed in cloud, virtual or physical server environments.
8. The web-based user interface supports secure HTTP browsing.
9. The software supports encryption to ensure secure access.
10. The system shall monitor itself if devices go offline and system actions are not received. Specified users shall receive email notifications when devices go offline. The software shall be able to keep a log and report on system activity within a school or all schools district-wide for a minimum of one year. These reports can be exported to excel spreadsheets.
11. The software will support a minimum of 20 bell schedules per school, with 5 schedules assignable to a specific school day. Bell schedules can be programmed to annunciate tones, activate relays, send emails, activate program distribution, and notify SIP phones.
12. The system allows programmable end points to be automatically included or excluded for live paging, bell tones, or prerecorded audio, depending on the time or day or day of the week. These inclusions/exclusions can be applied manually or automatically depending on their schedule.
13. The software can automatically send an email, as part of a programmed

- sequence of events, to district administrators alerting them of an emergency within the district.
14. The software provides the ability to view schools that are in an emergency status, using any web browser on the district's network. The software shall identify the name of the school in an emergency as well the type of emergency that school is in.
 15. The software provides the ability to view individual classrooms that are not checked-in during an emergency, using any web browser on the district's network. The software shall identify the name, extension, and description of the classroom that is not checked-in during the emergency.
 16. The system has a minimum of 5 customizable emergencies, one of them being an All-Clear – with the ability to return the system from an emergency to normal status. Each emergency shall have a minimum of 500 unique events.
 17. As a district-wide communications solution, the system shall be able to provide simultaneous communications to all schools or groups of schools within a district. The system shall allow a user to initiate district-wide communications to individual schools, all schools, or groups of schools, from a web-based user interface. The system shall allow a user to initiate prerecorded audio, live paging, or programmed sequences to individual schools, all schools, or groups of schools, from the web-based user interface. Programmed sequences shall be customizable per school, and the system shall be able to activate them simultaneously to individual schools, all schools, or groups of schools, from the web-based user interface.
 18. The communications software must allow upgrade from an individual school system to multiple schools, or an entire school district, using the same web-based user interface. The communications software from an individual school system must be identical in typical user operation to the multiple schools or entire school district communications system software.
- B. Campus Controller
1. Provides call routing for paging and intercom for a single facility.
 2. System shall connect to the district provided Telephone Network via a SIP connection.
 3. Support a flexible numbering plan allowing two, three, four, five, or six-digit extensions.
 4. SIP interface to a district provided Telephone Network shall be capable of allowing connected phones to display classroom call-ins, answer internal intercom call-ins, make pages, and change priorities of call-ins in progress.
 5. Direct dialing, two-way amplified voice intercom between any provided telephone or admin console and speaker without the use of a press-to-talk or talk-listen switch.
 6. Ability to upgrade priority level from individual call switch.
 7. The ability to answer intercom call-ins registered at administrative consoles and pre-selected telephones.
 8. The ability to automatically escalate incoming call-ins to an alternate telephone or group of telephones if they remain unanswered for a predetermined amount of time.
 9. The ability to manually upgrade an intercom call-in to an alternate telephone or group of telephones.
 10. The ability for classrooms to “check-in” via push button when they have successfully secured their location during emergency.
 11. Administrative console shall display locations that have not checked in to confirm their secured location and provide hands-free audio monitoring and communication to unsecured locations.
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12. The controller shall not need direct connection to any classroom via home run or distributed wiring. It shall communicate solely through the IP network.
 13. Single button access from any console on the system to distribute emergency announcements within the facility to all or select locations equipped with speakers. Emergency announcements originating from any assigned administrative console shall have priority over all regular system functions.
 14. Ability for administrative consoles and connected phones to selectively monitor audio at any two-way speaker during an emergency.
 15. Stores a minimum of 48 hours' worth of Bell Event Schedules, all emergency notification sequences as well as facility wide configuration.
 16. System has the ability to sync system time to the Atomic Clock Signal or to the school's or districts network time server.
 17. System's SIP Interface shall provide:
 - a. Audio paging access from any telephone to any single intercom speaker, zone (group) of intercom/paging speakers, or all speakers/paging horns throughout the entire facility.
 - b. Ability to answer a call-in directed to that SIP extension.
 - c. Ability to upgrade a call-in directed to that SIP extension.
 - d. Single button access from any telephone on the system to initiate alarm signals within the facility to all or select locations equipped with speakers. A minimum of 25 separate distinct alarm signals shall be provided. Alarm signals originating from any assigned administrative telephone shall have priority over all regular system functions.
 - e. Ability to initiate a school-wide emergency including lockdown and evacuate sequences.
 - f. SIP device shall display call-in information from call in switch. Information will include a minimum of Classroom Name, Number, and Priority Level.
 18. The system will have the ability to utilize a web browser and a USB microphone connected to the PC to deliver district-wide live emergency paging, pre-recorded messages, and tones from any authorized computer in the facility or the district. The system must be capable of automatically notifying district personnel via the WAN of an alarm condition.
 19. The system can automatically broadcast emergency instructions throughout an entire campus when an alarm (e.g., lockdown, lockout, security, fire) is tripped or manually activated. The emergency instructions are preprogrammed and require no user intervention. Bell tones can be halted during an emergency. The system provides redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.
- C. IP Addressable Modules:
1. System shall provide multiple IP Addressable Modules for intercom, paging and relay activation.
 - a. All Modules are POE 802.3af compliant
 - b. All Modules support DHCP.
 - c. All Modules connect to network with a single RJ45 connector
 2. IP Addressable Speaker Module
 - a. Shall interface to school's data network, a classroom speaker, and multiple call switches.
 - b. A minimum of 5 levels of call-in can be placed from an IP Speaker Module. The call-ins are routed to administrative consoles and select SIP connected telephones and can only be cleared from the system once answered. If a call-in is not answered within a preprogrammed time the call-in may reroute to other telephones, consoles, and speakers.
 - c. An option for Privacy call in switches is supported. When the Privacy

- switch is activated, it prevents administrative or classroom telephones from monitoring the specific classroom/location intercom speaker.
- d. The ability to belong to one or more of a minimum of 100 independent zones for zone paging, program/music distribution zones and class change tone zones; this assignment is a programmable function, changeable by time of day. Each IP Speaker Module's location shall be programmed in software to belong to any combination of software zones. IP Speaker Modules shall be designed to mount near ceiling and wall speakers and in the plenum space.
- e. Intercom and paging volume adjustable from Software interface.
- 3. IP Addressable Zone Paging Module
 - a. Zone Paging Module shall connect multiple speakers for district all page, all page, zone paging, bells, audio events and, emergency notification.
 - b. Zone Paging Modules shall be rack and wall mountable.
 - c. Zone Paging Modules shall be able to belong to one or more of 100 independent zones for live paging, bells, pre-recorded audio, and emergency notification.
- 4. IP Addressable Aux I/O Module
 - a. Aux I/O Module shall have two input contacts and two output contacts.
 - b. Input and output contacts are individually addressable.
 - c. Aux I/O Module shall be wall and rack mountable.
 - d. User can program relays to be activated manually, through an event/bell schedule, or during emergency notification.
 - e. Aux I/O Module can perform school lockdown from a single press of a panic button.
- 5. IP Addressable Program Line Input Module
 - a. Program Line Input Module shall provide line level audio program distribution into system.
 - b. Program Line Input Module shall have a 3.5mm cable jack.
 - c. Program Line Input Module shall be configured via web-based user interface.
 - d. User can configure program distribution to be activated manually or automatically through an event/bell schedule.
 - e. Program Line Input Module will have a system priority level such that emergency communications override program distribution.
- D. IP Addressable Analog Gateway
 - 1. IP Addressable Gateway provides integration with existing analog wiring infrastructure – consisting of shielded two-pair classroom field wiring. The Gateway provides the ability to reuse speaker wiring, speakers, and punch blocks to integrate analog infrastructure with IP platform.
 - 2. Each Gateway will have 5 watts of power per port and 25 watts total per device.
 - 3. Supports 24 classrooms that utilize 25 Volt speakers and all current Telecenter call switches for front office notification.
 - 4. Supports minimum of 5 call switch priorities per classroom, capable of lockdown check-in functionality, while reusing existing shielded two-pair classroom field wiring.
 - 5. Classroom intercom volume adjustable from Software interface.
 - 6. Classroom paging volume adjustable from Software interface.
 - 7. Configured to the school network and can be used in conjunction with IP Addressable Modules.
- E. IP Addressable Administrative Console
 - 1. A full color screen with 64 soft keys, 3 line select, volume control, push to talk, speakerphone mode and left/right and up/down scrolling.

2. Audio paging access from any Console to any single intercom speaker, zone (group) of intercom/paging speakers, or all speakers/paging horns throughout the entire school.
 3. Programmable soft key access from any console on the system to initiate alarm signals within the school to all or select locations equipped with speakers. A minimum of 25 separate distinct alarm signals shall be provided. Alarm signals originating from any assigned administrative console shall have priority over all regular system functions.
 4. Programmable soft key access from any console to automatically broadcast page emergency instructions throughout an entire school when an alarm (e.g., lockdown, lockout, security, fire) is tripped or manually activated. The emergency instructions are preprogrammed and require no user intervention. The system provides redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.
 5. Ability to perform intercom to any single IP Addressable Speaker Module.
 6. Ability to display 3 call-ins at a time on the screen while other call-ins are annunciating and the ability to scroll to view all call-ins.
 7. Ability to upgrade a call-in via soft key.
 8. Programmable soft key access from any console for activating relays, campus wide.
 9. Ability to maintain, along with controller and other IP Modules system functions, including intercom, bells and paging for the local campus in the event of district-wide connection loss.
 10. Classrooms that have not 'checked-in' during an emergency are listed on the Administrative Console's screen.
 11. The time duration of an emergency is shown on the screen of the administrative console. The check-in timer is shown on the screen of the administrative console.
- F. Audio Paging/Program Amplifiers – Ashly NE 8250
1. Power amplifier(s) shall be provided to provide a minimum of 2 watts of power to all paging speakers, and 15 watts of power to all paging horns.
 2. The maximum load on the paging/program amplifiers shall be 80% of the rated maximum output of the amplifiers.
- G. Normal/Emergency Call Switch – Rauland Dual Level Call-In Switch
1. Normal/Emergency Call Switches indicated on the drawings shall provide the following functions and features:
 - a. One (1) "Normal" call switch that shall activate a distinctive "NORMAL" level call from single button activation. The button shall be clearly marked "NORMAL" and will route the call-in to any one or more Administrative Consoles and/or Marquee Displays for quick and easy response from an Administrative Console.
 - b. One (1) "Emergency" call switch that shall activate a distinctive "EMERGENCY" level call from single button activation. The button shall be red in color and shall be clearly marked "EMERGENCY" and will route the call-in to any one or more Administrative Consoles and/or Displays for quick and easy response from an Administrative Consoles.
- H. Emergency/Check-In Call Switch – Rauland Check-In Call-In Switch
1. Emergency/Check-In Call Switched indicated on the drawings shall provide the following functions and features:
 - a. One (1) "Emergency" call switch that shall activate a distinctive "EMERGENCY" level call from single button activation. The button shall be red in color and shall be clearly marked "EMERGENCY" and will route the call-in to any one or more Administrative Consoles and/or Displays for quick and easy response from an Administrative Consoles.

- b. One (1) “CHECK-IN” call switch that shall activate a distinctive “CHECK-IN” level call from single button activation. The button shall be blue in color and shall be clearly marked “CHECK-IN” and will route the call-in to any one or more Administrative Consoles. This button will be used for emergency check-ins during school emergencies, notifying the front office of the classroom occupants’ safety during an emergency.
- I. Equipment Racks
 - 1. All equipment racks shall provide 44 spaces (77”) minimum for mounted system equipment.
 - 2. All equipment racks shall be multi-rack format (“gangable”) style, bolted together, and open cavity.
 - 3. All equipment racks will be provided with lockable rear doors.
 - 4. Equipment rack(s) shall be located in climate-controlled areas/rooms as shown on drawings.
 - 5. All head-end, distribution, and source equipment, including data and power, shall be located in racks configured as approved by the Engineer.
 - 6. Rack mounted equipment shall be accessible from front and rear.
 - 7. All unused rack spaces will be covered with appropriate blank/vent panels.
 - J. Interior Ceiling Speakers
 - 1. Provide Ceiling Speaker Assembly consisting of 8 Ohm, 8” speaker mounted in a 2 foot by 2 foot, lay-in baffle, with an integrated back box that covers the full area of the baffle.
 - 2. The speaker shall be connected by inserting an 8-pin RJ45 terminated CAT 5e or Cat 6 cable.
 - 3. The speaker shall include provisions to allow attachment of a safety cable if required.
 - K. Wall Mounted Horns
 - 1. Provide double re-entrant type horn loudspeakers with integral driver. The horn loudspeaker shall be impervious to weather and vandalism. Horn shall be constructed of heavy-duty ABS plastic. Horn loudspeaker drivers shall be rated at 15 watts with a frequency response of 480 Hz to 14 KHz. Sensitivity shall be 106 dB 1 watt, 1 meter. Transformer assembly shall be dual voltage multi-tap type suitable for 25 or 70-volt installations. Dispersion pattern shall be 180 degrees conical. The horn loudspeaker shall be constructed of treated heavy gauge aluminum, with all exposed parts potted and a sealed driver. Wiring terminal shall be fully enclosed. The speaker flange and mounting surface shall have a cork-rubber gasket. The horn loudspeakers finish shall be gray baked on enamel.
 - 2. The recessed back box shall be of heavy gauge cold-rolled steel, spot welded for stability with a rust-retardant gray primer finish. Acoustically treat the interior to eliminate mechanical resonance. The back box shall be 10-3/4”x10-3/4”x6” deep.
 - 3. The baffle shall be vandal proof, the faceplate constructed of 14-gauge carbon steel with a minimum tensile strength of 55,000 PSI. A lattice grid sub-plate shall deny access to the horn but be acoustically transparent for sound projection. Provide tamper-proof, stainless steel mounting hardware. The baffle shall have a mar/scratch baked epoxy rust inhibitive finish.
 - L. Uninterruptible Power Supplies (UPS)
 - 1. UPS equipment provided for this system will include Power Conditioning to smooth current and voltage fluctuations.
 - 2. UPS equipment will be sized in accordance with the system manufacturer’s recommendations.
 - 3. Provide an individual UPS for EACH remote gateway outside of the MDF (Gateway) furnished with the system.
 - 4. Provide additional UPS(s) for protection of all other equipment furnished with the

- 5. system and housed in the equipment racks.
- 5. All UPS equipment shall be rack mounted.
- M. Wall Mounted Volume Control
 - 1. Provide as shown on floor plans. Provide Atlas AT-10PA or approved equal recessed autotransformer volume control. Routine paging shall not override the volume control.
- N. Wall Mounted Emergency Lockdown Button
 - 1. Provide Safety Technology International Stopper Station Push, Turn-to-Reset w/shield w/sound, or pre-approved equal in locations as shown on floor plans.
 - 2. Labeled "LOCKDOWN"
 - 3. Lockdown shall be Blue
- O. Program Source Equipment
 - 1. Provide Qty 1 cd player with blue tooth Interface
 - 2. Provide 1 Program Source Module to interface with the IP Communications system
 - 3. Provide a Mixer Preamp for use in adjusting Sound levels
 - 4. Provide an Interface panel for additional sources and 1 paging Microphone
 - 5. Provide 1 desk top paging Microphone
 - 6. Provide Desktop enclosure to house all program source equipment
- P. Additional Equipment:
 - 1. Contractor shall include in their pricing, the cost to furnish and install the following additional equipment. These devices shall be used to fulfill any changes request issued until the list is depleted. Upon the completion of the project, all remaining material shall be delivered to the project for owner stock. No devices shall be used without documentation and written authorization from the project's technology consultant. Contractor shall obtain a signed transmittal of additional equipment to the owner at the end of the project. The signed transmittal shall be included in the contractor's closeout documents.
 - 2. Additional Equipment List:
 - a. Five (5) Ceiling Mounted Speakers with tile bridges
 - b. Two (2) Wall Mounted Volume Controls
 - c. One (1) Exterior Speakers

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the School Communications and School Safety Network.
- B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install system in accordance with NFPA 70 and other applicable codes. Install equipment in accordance with manufacturer's written instructions.
- B. Furnish and install all material, devices, components, and equipment for a complete operational system.
- C. Impedance and Level Matching: Carefully match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.
- D. Control Circuit Wiring: Install control circuits in accordance with NFPA 70 and as indicated. Provide number of conductors as recommended by system manufacturer to provide control functions indicated or specified.
- E. All housings are to be located as indicated.
- F. The contractor shall provide necessary transient protection on the AC power feed, all

- copper station lines leaving or entering the building, and all central office trunks. All protection shall be as recommended by the equipment supplier and referenced to earth ground.
- G. Wiring within Enclosures: Provide adequate length of conductors. Bundle, lace, and train the conductors to terminal points with no excess. Provide and use lacing bars.
 - H. Provide physical isolation from speaker-microphone, telephone, line-level wiring, and power wiring. Run in separate raceways, or where exposed or in same enclosure, provide 12-inch minimum separation between conductors to speaker-microphones, telephone wiring and adjacent parallel power. Provide physical separation as recommended by equipment manufacturer for other system conductors.
 - I. Identification of Conductors and Cables: Use color coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams.
 - J. Provide integration of local sound reinforcement system override.
 - K. Provide integration of remote lockdown pushbuttons.
 - L. Install new speaker types as indicated on the drawings.
 - M. Speakers in high ambient noise areas (cafetorium, gymnasiums, etc.) shall be tapped as required to overcome the ambient noise generated by the public.
 - N. Provide silicone sealant to all openings and conduit penetrations at all exterior back box locations.
 - O. Weatherproofing: Provide weatherproof enclosures for items to be mounted outdoors or exposed to weather.
 - P. All exterior wall penetrations shall be properly sealed to prevent moisture from entering the building.
 - Q. Conduit and Cables
 - 1. Install conduit, fittings and boxes as specified in Division 26.
 - 2. Single system cables shall be grouped together in a common conduit of adequate capacity to facilitate the ease of installation and prevent conductor or insulation damage.
 - a. In no case shall the conduit fill exceed 40% capacity.
 - b. Do not group conductors or cables of different systems in a common conduit.
 - c. Provide and install protective bushings on all conduit stub outs and sleeves, prior to cable installation, to prevent cable damage.
 - 3. Cable:
 - a. Install cables as recommended by the system manufacturer. Conductor quantities specified are minimum required. Conductors to be installed shall be coordinated with the system equipment supplier.
 - b. Cables installed on exposed surfaces, in inaccessible locations, or underground shall be installed in conduit.
 - c. Cables installed above accessible ceiling spaces may be installed without conduit. All cables not installed in conduit shall be plenum rated.
 - d. Cables shall be routed down corridors, parallel and perpendicular to the building walls and structure. Cable to each device shall branch off a main corridor trunk.
 - e. Routing cables through classrooms, offices, storage rooms, restrooms, or any type of room other than a corridor will not be accepted. Enter rooms above the associated room doorway.
 - f. All cabling shall be home runs to head-end equipment to allow for zoning to be accomplished.
 - 4. Cables not installed in conduit shall be grouped and bundled. Cable shall be bundled on a maximum of 2'-6" on center. Support cables from D-rings or J-hooks. D-rings and J-hooks shall be secured to the structure at a maximum of 5'

- on center. Bundling and support shall be with plenum rated cable ties.
- 5. Cables installed in hollow wall spaces shall be installed in conduit to an accessible location.
- 6. Tag each circuit at each end and at each terminal with a separate tag indicating the area served.
- R. Emergency Lockdown Buttons
 - 1. Cabling for each Emergency Lockdown Button shall be homerun to the Communication System head-end equipment.
 - 2. Communications system shall communicate with intrusion system over the network when there is a lockdown event.
 - 3. Provide connection from the Communication System head-end equipment to the Intrusion Detection System head-end for sending notifications to the CFISD Police Department. Coordinate additional requirements and programming with Owner.
 - 4. Button shall cause the Intercom System to send a distinct alert tone throughout all speakers in the building. Coordinate exact tone with Owner.
 - 5. Button shall send an Emergency Call signal to all Administrative Call Stations.
 - 6. Communication System shall alert essential personnel via SMS and e-mail that a Lockdown event has occurred at the campus. Coordinate additional requirements with Owner.
 - 7. Buttons and alert tone shall be reset by pressing the All-Clear button on any Administrative Call Station console.
 - 8. Coordinate Emergency Lockdown Button device identification naming with Owner.
 - 9. Reference attachment 'A' for more information.
- S. Volume Controls
 - 1. Volume Controls shall be configured with emergency call override, allowing emergency announcements to be heard regardless of the position of the volume control.

3.3 ADDITIONAL REQUIREMENTS

- A. **Provide visual PA indicator light in deaf education areas and wire into the communications system for bell tones.**

3.4 GROUNDING

- A. Provide equipment grounding connections for Integrated Electronic Communications Network systems as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.
- B. Racks and cabinets shall be grounded to the metallic structure of the building or to the building system power ground in accordance with NEC section 250. Securely bond equipment to the ground system through a minimum 14-gauge green insulated conductor.
- C. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.
- D. Electronic systems shall be grounded to the building system ground, with a maximum resistance of 0.1 ohm. Systems ground shall be a driven ground rod, building steel, or other approved ground of the building power systems ground.
- E. Provide all necessary transient protection on the AC power feed and on all copper station lines leaving or entering the building. Note in system drawings, the type and location of these protection devices as well as all wiring information.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.
- B. Inspection: Make observations to verify that units and controls are properly labeled, and interconnecting wires and terminals are identified. Provide a list of final tap settings of paging speaker line matching transformers.
- C. Testing: Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

3.6 FINAL ACCEPTANCE TESTING

- A. The Final Acceptance Testing shall be provided to the Owner, or the Owners designated representative only. Final acceptance testing to any other trade or service provider for the project will not comply with the requirements of this section.
- B. The contractor will provide a Final Acceptance Test record document signed by both the contractor and the Owner or designated Owner's Representative establishing the "In Warranty" date. The warranty period will not commence until the Final Acceptance Test is completed.
- C. Be prepared to verify the performance of any portion of the installation by demonstration, listening and viewing test, and instrumented measurements. Make additional adjustments within the scope of work and which are deemed necessary by the Owner because of the acceptance test.

3.7 COMMISSIONING

- A. The contractor shall train the Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventative maintenance of the system. This training will be in accordance with the training as outlined in Section 1.6 of these specifications. In addition to the Training Materials provided, the contractor will also furnish Operators Manuals and Users Guides at the time of this training.
- B. Schedule training with Owner through the Owner's representative, with at least seven days advance notice.

3.8 OCCUPANCY ADJUSTMENTS

- A. The contractor shall provide Occupancy Adjustments in accordance with Section 1.6 of these specifications. A response scenario amenable to both the owner and the contractor will be established and followed for the first year of service.

3.9 CLEANING AND PROTECTION

- A. Prior to final acceptance, the contractor shall vacuum and clean all system components and protect them from damage and deterioration. All blank spaces in equipment cabinets will be covered with blank panels. Top and side panels, and all cabinet doors will be installed. All general areas within and around all equipment rack/cabinets in the facility will be swept, vacuumed, and cleaned up. No cabinets will be left unlocked, and all cabinet keys will be turned over to the owner or designated owner's representative.

ATTACHMENT 'A'

PROJECT SPECIFIC SCOPE OF WORK AND INSTRUCTIONS

PART 1 – SUMMARY OF WORK – INTERCOM AND CLOCKS

1.1 DESCRIPTION OF WORK

- A. This project consists of the provision and installation of a Intercommunications system as required to support intercommunications, clocks and lockdown buttons. This project is a renovation of Cy Ranch HS for Cypress-Fairbanks ISD.
- B. The work includes provision and installation of a complete Intercom System in compliance with these specifications and associated drawings, pre-proposal addenda, change orders, change directives and any other documents issued both pre-proposal and during the project.
- C. It should not be assumed that any portions of a complete and functional system are to be furnished and/or provided by anyone, other than the intercom system installer, unless specifically stated otherwise.
- D. Any network switches that are required shall be provided by the owner. Contractor is responsible for coordinating the switch requirements with the owner so the model of switch from the owners approved manufacture can support the systems needs.
- E. Scope of the project entails the expansion of the existing intercommunications system.
- F. Existing intercom system devices/wiring are to be integrated into Telecenter U system head end. Contractor to provide and install gateways to Telecenter U system to accommodate existing devices. Gateways are limited to 24w. Total of speaker connections to gateway shall not exceed 24w.

1.2 DESIGN REQUIREMENTS

- A. Provide a complete communications system capable of providing two-way speech communication between selected speaker stations or intercom handsets and main console. System shall also be capable of distributing sound and voice signals to all system speakers simultaneously or in user programmed groups of speaker stations.
 - 1. High School and Middle School classrooms shall have a speaker and a call button. Elementary School classrooms shall have an intercom speaker only. Call button to be Rauland Model #603302.
 - 2. All portable classrooms (A and B sides) shall be updated with IP speakers, Call Buttons and Lock Down buttons. Call Buttons in High Schools and Middle Schools only. Reuse existing call Button and Lock Down Button locations in portables.
 - 3. Reception desk and designated offices shall have Console Phones.
 - 4. All offices shall have a volume control for speakers.
- B. Fire Alarm System Interconnection: APPLICABLE IN HIGH SCHOOLS AND IN MIDDLE SCHOOLS – Main communications and local sound reinforcement systems in the Gymnasiums, Cafeteria, Natatorium, Black Box and Large Group Instruction shall be automatically muted during fire alarm system activation (NFPA Life Safety Code 101, 7-6.3.10 and National Fire Alarm Code 72, 3-8.13.5). However, school communication system shall remain capable of manual override so that school staff can deliver voice instructions over the school communications system, such as directing students to return after a fire drill.
- C. The system shall be supplied by the manufacturer's authorized contractor, Rauland, Certification shall be submitted verifying that the contractor is the manufacturer's authorized contractor. Included shall be certificates of attendance in manufacturer's installation / maintenance training by the contractors directly employed personnel. The

communications contracting company shall have been in business for a minimum of 5 years, continuously furnishing the specified manufacturers' product lines and systems.

- D. The system assemblies shall be completely factory built and tested by manufacturers of established reputation, who have and can refer to similar systems which are currently installed and functioning properly. The factory pre-assembled cabinets, consoles, and power supplies shall be UL approved and listed. whichever is first, against defects in materials, workmanship, design and improper adjustment. Any defects in the system shall be corrected at no expense to the Owner, provided the system does not show signs of abuse. During the guarantee period any work found not to be in conformance with the plans, specifications and addenda shall be brought into conformity with same at no additional cost to the owner.
- E. The equipment furnished shall be supplied by one communications contractor. The contractor shall hold the necessary License for this type of work. Contractor is required to submit current certification from manufacturer with submittals.
- F. Provide local wall mounted volume control in all offices, work rooms, conference rooms, teaching theaters, large teaching areas, special needs classrooms, band, orchestra and choir and all practice rooms. Provide volume control at intercom/P.A. rack for auditorium all dressing rooms and corridors around auditorium, cafeteria, and corridor circuits for Middle and High Schools.
- G. Provide call in switch on wall closest to door leading to hallway in Middle and High Schools. Button to be Rauland model #603302. Red EMERGENCY and white NORMAL call in.
- H. Provide IP admin phone and microphone at receptionist, principal's office, AP secretary, all AP's and any admin suite.
- I. ADDITIONS/RENOVATIONS (Existing buildings w/analog recording).
 - 1. Maintain a fully functioning system in unaffected areas.
 - 2. Remove all abandoned equipment and return to owner, remove all abandoned wiring and patch surfaces at wall and floor penetrations.
 - 3. Maintain access to all existing equipment.
 - 4. Prior to construction, a system test will be required of the contractor to demonstrate the current state of the system. Any non-functioning item at this time shall be noted and addressed by CFISD Maintenance. If system is proven to be 100% functional, the contractor is responsible to any repair necessary to return it to its previous state.
 - 5. At Substantial Completion or when system is ready to be tested, a demonstration is required by the contractor to demonstrate the system mirrors the system condition prior to construction. If system is not functioning the same prior to construction, the contractor shall make necessary repairs to bring the system back up to the pre-construction condition.

PART 2 – SUMMARY OF WORK

2.1 INTERCOM SYSTEM – ADDITIONAL INSTRUCTIONS

- A. Manufacturers:
 - 1. Telecenter U IP (new campuses) by Rauland – No Exceptions.
 - 2. Existing CFISD campuses have Telecenter U. During renovations, IP modules can be added. Confirm with CFISD during design.
- B. Program Source:
 - 1. Use single gang input jack at reception desk. RDL D-J3 Wall mount RCA and XLR Mic/Line Input Panel or equal. Location of this jack may be different for each school, depending on counters and cabinets. Jack shall be mounted near an outlet for power requirements. This replaces CD player, radio, mixer and

desktop rack unit. Jack is to be wired and run to head end rack where it connects to Telecenter U Line Input Module. Use copper/analog wiring, not Cat 6 network wiring.

- C. Classroom Speakers for IP System:
 - 1. Rauland TCC2011A IP Module with BAFKIT2X2L8RJ Speaker or equal, to be used in classrooms.
- D. Office and Hallway Speakers:
 - 1. Quam 17URS 2X2 Lay-In Speaker or equal. These offices shall have a volume control.
- E. Bathroom and Hard Ceiling Speakers:
 - 1. Rauland ACC 1400 or equal with backcans.
- F. Wall-mount Surface Speakers - provide flush mount type
- G. Cafeteria and gym intercom speakers should cover entire area; a minimum of six (6) speakers in each gym and nine (9) in each cafeteria. Additional speakers shall be added if required for better coverage.
- H. Exterior Mounting: Flush mount with vandal-resistant metal baffle similar to Atlas / Soundolier Model VP161-APF. Baffle shall be square and designed for flush mounting. Provide backbox designed for flush mounting. Backbox shall be metal with all-welded seams and undercoated to eliminate mechanical resonances. Box shall have rust-resistant coating. Backbox shall be Atlas/Soundolier Model 193 Series deep box for specified speaker and baffle or approved equal. Install gaskets to seal enclosure to speaker. Backboxes and conduit shall be sealed and secured to the building.
- I. SURGE PROTECTOR: Provide over voltage and transient spike surge protector to condition AC voltages into all microprocessed control systems. Tripp Lite IsoBar.
- J. WIRE: Wire shall be #22 gauge at a minimum. Wire for communications system shall consist of (1) twisted pair #22 copper under jacket and one (1) twisted pair #22 under shield copper with overall plenum rated PVC jacket. No splices are permitted except in approved junction boxes. All terminations shall be made on telephone type punch blocks or at specified devices. Display, speaker, and specialty cables shall be as required for best operation under manufacturer recommendations. All IP speakers/modules shall be wired by structured cabling contractor. All local low voltage by intercom contractor.
- K. JACKS: All station device terminations (except speakers) shall be terminated on USOC standard modular jacks. Jacks for wall mounted telephones shall have lugs for securely attaching the instrument to the wall.
- L. BACKBOARDS: Provide 4 foot x 8 foot plywood backboards for mounting of system cross connect field. Mount as shown on the plans. Provide Modular Termination backboards with 66 type terminal blocks as required to terminate all cables. Provide distribution and cross connect backboards equal to AT&T 66 type Series for all cross connect wiring.
- M. CAMPUS CONTROLLER: Integrates with existing District-wide Cisco IP phones. Coordinate with CFISD during design.

- N. HYBRID MODULES: for all 25/70V applications, ie corridors / exterior horns, provide and install 24-port hybrid gateways and ZPM modules.
- O. CLOCK SYSTEM
 - 1. At new construction, provide Master Clock Power Supply and Clocks by Sapling. Clocks are to be installed in the following locations only:
 - a. Cafeteria / Commons – 16-inch clock
 - b. Library – 16-inch clock
 - c. Clinic – 12-inch clock
 - d. Gymnasium – Middle Schools and High Schools: 16-inch clock, with protective wire cage; Elementary Schools: LED message board with protective wire cage(no clock).
 - e. Behind receptionist area – 12-inch clock
 - 2. At all renovations, provide Master Clock, Power Supply and Clocks by Sapling. Clocks are to be installed at the following locations:
 - a. Cafeteria / Commons – 16-inch clock
 - b. Library – 16-inch clock
 - c. Clinic – 12-inch clock
 - d. Gymnasium – Middle Schools and High Schools: 16-inch clock, with protective wire cage; Elementary Schools: LED message board with protective wire cage (no clock).
 - e. Behind receptionist area – 12-inch clock
 - f. All other clocks on this system to be removed and patched as required.

2.2 LOCKDOWN BUTTONS – ADDITIONAL INSTRUCTIONS

- A. Lock Down Buttons are to be Make STI and Model SS24A1EM-EN only. (BLUE IN COLOR)
- B. Inside all Main Buildings, wiring for Lock Down Buttons is to be run to the Intercom Head End.
- C. Mounting:
 - 1. Lock Down Buttons in all corridors are to be mounted at 42 inches to center of Button.
 - 2. Lock Down Buttons in all other locations are to be mounted to match light switches and other buttons that meet ADA standards. No Lock Down Button to exceed 48 inches in height.
- D. The wire circuit is to be hooked up to the normally open relay on the lock down button and run to a TCC 2024 24 port gateway at the head end. Each gateway input is programmed with the lock down button description.
- E. Additionally, a cable is run from the Intercom headend to the Burglar/Security headend panel to send notification to our Central Station. This allows the Central Station to also be notified in an instance where the school has activated the lock down system.
- F. When the button is activated, the Intercom system sends a distinct tone throughout the building. The tone is the same for all campuses, letting everyone know what they should be doing without having to make an announcement. NOTE: It is not the burglar system sending the tone.
- G. Provide (10) STI model SS24A1EM-EN lock down buttons for each campus in the project.
- H. ACCEPTABLE WIRING METHODS - The District has two acceptable wiring methods for Lock Down Buttons.
 - 1. Inside Main Buildings: Run a home run wire from each Lock Down button to the Intercom Head End. The wire shall be white jacket plenum rated 18 gauge single pair red/black. The wire shall be connected to the Normally Open relay on the

- Lock Down Button and to a TCC 2024 gateway to trigger a Lock Down. The Module shall be programmed to identify the circuit, zone and button.
2. Inside Portable Buildings: Run a wire circuit to an IP speaker from each Lock Down Button. One wire circuit on the portable A side and one on the B side. The wire shall be plenum rated white jacket 18 gauge single pair red/black. The red/black colored wire is run from the Lock Down Button Normally Open Relay to the IP speaker and terminated on an RJ45 plug (CALRAD Electronics 72-RJ45-T). Each IP speaker module(TCC2011A) has an RJ45 jack on it for AUX inputs. The RJ45 (CALRAD Electronics 72-RJ45-T) is plugged into the Aux Input of the speaker module. The intercom System uses special programming to activate the Lock Down system. (see special programming below).
 - a. Special Programming: Special programming can be created for Lock Down Buttons to work independently or with another call button on the same wire circuit. A 220-ohm resistor is need on the call button when used with a Lock Down Button. This will let the system know which button is being used. Call buttons are only used at High Schools and Middle Schools. Trained technicians will do this programming.

END OF SECTION

**SECTION 28 0100
OPERATION AND MAINTENANCE (O&M) MANUALS
OF ELECTRONIC SAFETY AND SECURITY SYSTEMS**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Compile Electronic Safety and Security (ESS) product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare ESS operating and maintenance data as specified in this Section and as referenced in other sections of specifications.
- B. Instruct Owner's personnel in operation and maintenance of equipment and systems.
- C. Submit three (3) electronic copies, on separate devices (CD, USB Flash Drive, or some type of solid-state storage device), of complete O&M manuals in final form. The submitted manual shall be the system manufacturer's operations manual, supplemented with operations and maintenance instructions custom tailored for the system installed. Electronic documentation shall be provided in a non-proprietary PDF format, without password restrictions.
- D. Hard copies shall be provided upon request of the Owner, Architect, and/or Consultant.
- E. Recorded video of all training sessions shall be included in each copy, of each system's final submitted O&M.
- F. The final submitted manual shall include a sign-in sheet and owner/consultant signed acceptance of all training sessions.

1.2 ELECTRICAL OPERATING AND MAINTENANCE MANUAL SUBMITTAL SCHEDULE

- A. Thirty (30) days after receipt of reviewed submittals bearing the Project Technology Consultant's stamp of acceptance (including re-submittals), submit for review, an electronic copy of the first draft of the System's O&M Manual. This copy shall contain as applicable to the specific system, a minimum of the following:
 - 1. Table of Contents for each element
 - 2. Contractor information
 - 3. All shop drawings, coordination drawings and product data, bearing the Project technology Consultant's stamp of acceptance.
 - 4. All parts and maintenance manuals for items of equipment
 - 5. Warranties (without starting dates)
 - 6. Certifications that have been completed; submit forms and outlines of certifications that have not been completed
 - 7. Operating and maintenance procedures.
 - 8. Form of Owner's Training Program Syllabus (including times and dates)
 - 9. Control operations / equipment wiring diagrams
 - 10. Coordination Drawings
 - 11. Schedule of Low Voltage Wire and Cable
 - 12. Schedule of ESS Equipment
 - 13. Schedule of ESS Field Devices
 - 14. Access Control Door Schedules
 - 15. Video Surveillance Camera Schedules
 - 16. Other required operating and maintenance information that are complete.
 - 17. Cable pathway layout drawings and station map, including through wall and floor penetration locations and sleeve sizes.
- B. Copy will be returned to the Contractor within 15 days with comments for corrections.
- C. Submit the electronic completed manuals (hard copies upon request) in final form to the Project's Technology Consultant.
 - 1. Prior to substantial completion for Owner's use after the Owner accepts facility maintenance.

2. Include all specified data, test reports, drawings, dated warranties, certificates, training videos. along with other materials and information.
- D. The Project's Technology Consultant shall review the manuals for completeness within 15 days.
- E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Project's Technology Consultant. The manuals will not be retransmitted.
- F. Electronic and/or hard copies of the accepted manuals shall be delivered to the Owner prior to substantial completion.

PART 2 - PRODUCTS

2.1 BINDERS

- A. Upon the request for hard copies of the O&M manuals, the binders shall consist of the following configuration:
 1. Commercial quality black, 3-ring binders with clear, durable, cleanable plastic covers.
 2. Minimum ring size: 1"; Maximum ring size: 3".
 3. When multiple binders are used, correlate the data into related groupings.
 4. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 SYSTEM OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals Submitted in Hard Copy Format:
 1. Prepare data in form of an instructional manual for use by Owner's personnel.
 2. Format:
 - a. Size: 8-1/2" x 11"
 - b. Text: Manufacturer's printed data or neatly typewritten.
 3. Drawings:
 - a. Provide reinforced punched binder tab and bind in text.
 - b. Fold larger drawings to size of text pages.
 4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
 5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
 - a. Title of Project
 - b. Identity of separate structures as applicable
 - c. Identity of general subject matter covered in the manual.
 6. Binder as specified
- B. Content of Manual:
 1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
 - a. Contractor, name of responsible principal, address and telephone number
 - b. A list of each product required to be included, indexed to content of the volume.
 - c. List with each product, name, address and telephone number of:
 - 1) Subcontractor or installer
 - 2) Maintenance contractor as appropriate
 - 3) Identify area of responsibility of each.
 - 4) Local source of supply for parts and replacement
 - d. Identify each product-by-product name and other identifying symbols as set forth in Contract Documents.
 2. Product Data:

- a. Include those sheets pertinent to the specific product.
 - b. Annotate each sheet to:
 - 1) Identify specific product or part installed.
 - 2) Identify data applicable to installation.
 - 3) Delete references to inapplicable information.
 - 3. Drawings:
 - a. Supplement product data with drawings as necessary to illustrate:
 - 1) Relations of component parts of equipment and systems
 - 2) Control and flow diagrams
 - b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
 - c. Do not use Project Record Documents as maintenance drawings.
 - 4. Written text as required to supplement product data for the particular installation:
 - a. Organize in consistent format under separate headings for different procedures.
 - b. Provide logical sequence of instructions for each procedure.
 - 5. Copy of each warranty, bond and service contract issued
 - a. Provide information sheet for Owner's personnel, giving:
 - 1) Proper procedures in event of failure
 - 2) Instances that might affect validity of warranties or bonds
 - 6. Shop drawings, coordination drawings and product data as specified.
- C. Sections for Equipment and Systems
- 1. Content for each unit of equipment and system as appropriate:
 - a. Description of unit and component parts:
 - 1) Function, normal operating characteristics, and limiting conditions.
 - 2) Performance curves, engineering data and tests.
 - 3) Complete nomenclature and commercial number of replaceable parts.
 - b. Operating procedures:
 - 1) Start up, break-in, routine / normal operating instructions
 - 2) Regulation, control, stopping, shut down and emergency instructions
 - 3) Special operating instructions
 - c. Maintenance procedures:
 - 1) Routine operations
 - 2) Guide to trouble-shooting
 - 3) Disassembly, repair and reassembly
 - 4) Alignment, adjusting and checking
 - 5) Routine service based on operating hours
 - d. Manufacturer's printed operating and maintenance instructions.
 - e. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
 - 1) Items recommended to be stocked as spare parts.
 - f. Schedule of low voltage wire and cable
 - g. Schedule of ESS equipment
 - h. Schedule of ESS field devices
 - i. Each Contractor's coordination drawings.
 - 1) As installed color coded wiring and cabling diagrams.
 - j. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
 - k. Other data as required under pertinent sections of the specifications.

2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications
4. Provide complete information for products specified in Division 27.
5. Provide certificates of compliance as specified in each related section.
6. Provide start up reports as specified in each related section.
7. Provide signed receipts for spare parts and material.
8. Provide training report and certificates.

END OF SECTION

SECTION 28 0500
ELECTRONIC SAFETY AND SECURITY
BASIC MATERIALS, METHODS, AND GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of Division 01 General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 28 Electronic Safety and Security.
- B. Applicable provisions of this section apply to all sections of Division 28, Electronic Safety and Security.
- C. The general provisions of the Contract and the requirements of the following Sections apply to the Work specified in this Section. See following sections for related general and specific requirements following sections shall associate with this specification as applicable.
 - 1. Division 26 in its entirety.
 - 2. Division 27 in its entirety.
 - 3. Division 28 in its entirety.
- D. The entire drawing and specification package apply to the work specified in the Electronic Safety and Security specifications and shall be complied with in every respect. The Contract Documents are comprised of the drawings and specifications. The Contractor shall examine these Contract Documents, and coordinate required work indicated in each.

1.2 CODES AND STANDARDS

- A. All equipment and work performed shall comply with all of the current and applicable Codes, Rules, Ordinances, Regulations and Standards (including those not specifically listed in this Specification) as interpreted and enforced by the authorities having jurisdiction including:
 - 1. Americans with Disabilities Act (ADA)
 - 2. Authorities Having Jurisdiction (AHJ) - Local
 - 3. American National Standards Institute (ANSI)
 - 4. American Society of Testing and Materials (ASTM) *Communications Cables - B694, B736, D4565, D4566, D4730, D4731, D4732*
 - 5. Building Industry Consulting Services International (BICSI)
 - 6. Code of Federal Regulations - Title 47
 - 7. Electronics Industries Association (EIA) *Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices - EIA-455 Series*
 - 8. Federal Communications Commission (FCC) - Communications Act and FCC Rules
 - 9. Federal Information Processing Standards (FIPS) *Federal Building Standard for Telecommunications Pathways and Spaces - FIPS PUB 175, FIPS PUB 176*
 - 10. The Insulated Cable Engineers Association (ICEA) *Communications Cable Stands - P-47-434, S-56-434, S-80-576, S84-608, S-85-625, S-86-634, S-87-640, S-89-648, S-90-661, S-98-688, S-99-689, S-100-685*
 - 11. International Electro-technical Commission (IEC)
 - 12. Institute of Electrical and Electronic Engineers (IEEE) *Local Area Networks/Metropolitan Networks Standards Collection - LAN/MAN 802 Series*
 - 13. International Organization for Standardization (ISO) (ISO/IEC) *Premise Wiring Core and LAN/MAN Core Equivalents-11801, 8802, 14763-1*
 - 14. International Telecommunication Union (ITU-T) *Telecommunications*

Standardization

15. National Electrical Code (NEC) *National Electrical Code - NFPA 70*
 16. National Electrical Contractor's Association (NECA) *Standards of Installation*
 17. National Electrical Manufacturers Association (NEMA) *Performance Standard for Twisted Pair Premise Voice and Data Communications Cable-WC 63.1, WC 63.2, WC 66*
 18. National Electrical Safety Code (NESC)
 19. National Fire Protection Association (NFPA) - *National Fire Alarm Code NFPA 72, Life Safety Code NFPA 101*
 20. Society of Cable Telecommunications Engineers (SCTE)
 21. Local Accessibility Standards
 22. Telecommunications Industries Association (TIA) (*ANSI/TIA/EIA Wiring and Cabling Standards - 526, 568, 569, 570, 571, 598, 606, 607, 758, TSB 31-B, 63, 67, 72, 75 and 95*)
 23. Uniform Building Code (UBC)
 24. Underwriters Laboratories, Inc. (U.L.) - *497A, 910, 1077, 1863, 1283, 1459, 1604, 1651, 1681, 1690, 1778, 1977*
- B. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.
- C. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.
- D. Obtain all permits required.

1.3 SUMMARY

- A. The work covered by the specifications includes furnishing materials, labor, transportation, tools, permits, fees, utilities, and incidentals necessary for the complete installation of work required in the Contract Drawings.
- B. It is the intent of the Contract Documents to provide a new and/or an extension of the existing installation, as shown in the associated specifications and drawings, complete in every respect.
- C. Provide complete and working ESS Systems including equipment, conduit, wiring, material, labor and training as described in this Specification and the Drawings. The ESS Systems Drawings and Specifications are the sole property of the Architect and are not to be duplicated, scanned, loaned or in any way made available to persons not designated as authorized by the Architect. All ESS Systems plans and specifications are to be returned to the Architect following completion of bid.

1.4 CONTRACTOR'S QUALIFICATIONS

- A. An approved contractor for the work under this division shall be:
1. A specialist in this field and have the personnel, experience, training, and skill, and the organization to provide a practical working system.
 2. Able to furnish evidence of having contracted for and installed not less than ten (10) systems of comparable size and type that have served their Owners satisfactorily for not less than 3 years.
 3. Perform work by persons qualified to produce workmanship of specified quality. Persons performing work shall be required to be licensed. Onsite supervision shall have minimum of the following:
 - a. Licenses, as applicable to the system being installed
 - b. Manufacturer's Certifications
 - 1) Firm Certification
 - 2) Installer Certification
 - 3) Programmer's Certification

4) System Designer Certification.

1.5 DRAWINGS AND SPECIFICATIONS

- A. The drawings and these specifications are complementary to each other, and what is required by one shall be as binding as if required by both.
- B. If variations or departures from the drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted to the Consultant for review. No departures shall be made without prior written acceptance of the Consultant.
- C. Should the drawings or specifications disagree in themselves or with their counterpart, the better quality or greater quantity of work or materials shall be estimated upon, and unless otherwise directed by the Consultant in writing, shall be performed or furnished. In the case that the specifications should not fully agree with the Schedules, the latter shall govern. Figures indicated on drawings govern scale measurements and large-scale details govern small scale drawings.
- D. The approximate locations of system equipment and components are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of equipment, field devices, etc. Exact locations are to be determined by actual measurements at the building and will in all cases be subject to the Review of the Owner or Consultant, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.
- E. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.
- F. Any discrepancies between the Contract Documents and actual job site conditions shall be reported to the Owner or Consultant, so that they will be resolved prior to the bidding, where this cannot be done at least 7 working days prior to bid; the greater or costlier of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.
- G. It is the intention of this Section of the Specifications, and associated drawings, to outline minimum requirements to furnish the Owner with a turnkey and fully operating system in cooperation with other trades.
- H. The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the shop drawings accepted by project's consultant.
- I. The Contractor shall be responsible for coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself with the existing site conditions, details of the work and the working conditions, and verify dimensions in the field. The Contractor shall advise the project's consultant of any discrepancy prior to bidding. The submission of bids shall be deemed evidence of the Contractor's site visit; coordination of existing conditions and include consideration for existing conditions.
- J. These documents are conceptual in nature. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer's shop drawings and product data submittals shall represent a complete system and documents accepted by the project's consultant shall not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project's Technology Consultant and the Owner.

1.6 BUILDING CONSTRUCTION AND LAYOUT OF WORK

- A. General: It shall be the responsibility of the Contractor to consult the Engineering Drawings and Details so as to thoroughly familiarize himself with the type and quality of construction to be provided on this project.
- B. The drawings are diagrammatic in nature and do not show every connection in detail or every line or conduit in its exact location. These details are subject to the requirements of all codes, ordinances, and standards; as well as all structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in closed ceiling space and/or furred chases unless specifically noted or indicated to be exposed. Work shall be installed to avoid crippling of structural members. All work shall be run parallel or perpendicular to the lines of the building unless otherwise noted.
- C. The approximate location of equipment items is indicated on the drawings. Exact locations are to be determined by coordination of dimensions from approved equipment submittals and site-verified field measurements and will in all cases be subject to the approval of the Consultant. The Consultant reserves the right to make any reasonable changes in the indicated locations prior to installation for no additional cost.
- D. In areas of existing special ceiling construction, the removal and restoration must be carefully planned such that the existing condition of the ceilings is maintained. It may be necessary for the Contractor to procure a Subcontractor familiar with this work to achieve this requirement.
- E. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.7 RELATION WITH OTHER TRADES

- A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements. Extend electrical services and final connections to all items requiring same.
- B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.
- C. Where cabling pass through walls or floors, metal sleeves shall be provided and shall be sealed to prevent spread of fire and smoke. In walls, they shall extend 3" beyond the finished surface. In pipe chases, they shall extend 8" inches above floor slab and be cemented in a watertight manner. Size of these sleeves shall be at least as required to maintain a maximum 40% conduit fill ratio. 1/2 inch greater than outside diameter of the conduit.
- D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.
- E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under other Division. Determine from the General Contractor / Construction Manager for the various trades, the Owner, and by direction from the Architect / Engineer, the exact location of all items. The construction trades involved shall furnish all roughing-in drawings and wiring diagrams required for proper installation of the electrical work.
 - 1. Make final connections to all ESS equipment indicated on the drawings, except as noted.
- F. Request all Shop Drawings required in ample time to permit proper installation of all electrical provisions.

- G. Extend services as indicated to the various items of equipment furnished by others. Rough-in for the various items and make final connections ready for operation upon placing of the equipment.

1.8 CONCEALED AND EXPOSED WORK

- A. When the word "concealed" is defined as hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is defined as open to view, in plain sight.

1.9 GUARANTEE

- A. Guarantee work for a minimum of two years or as noted longer elsewhere from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.10 MATERIAL AND EQUIPMENT

- A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.11 NOISE AND VIBRATION

- A. Select equipment to operate with minimum noise and vibration. If noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, and judged objectionable by the Owner, Architect, or Engineer, rectify such conditions at no additional cost to the Owner. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.12 ACCEPTABLE MANUFACTURERS

- A. Manufacturers names and catalog number specified under sections of Division 28 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer shall be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before proposal due date. Submit complete design and performance data to the Architect. The Architect and Owner issue approvals of acceptable manufacturers as addenda to the Construction Proposal Documents.
- B. Where acceptable manufacturers are listed, only products of those manufacturers may be provided. Additionally, the product must meet all the detailed requirements of the specifications.
- C. If no manufacturer's name is mentioned, the Contractor shall provide equipment and material which meet the specifications.

1.13 UTILITIES, LOCATIONS AND ELEVATIONS

- A. Locations and elevations of the various utilities included within the scope of this work:
 - 1. Obtained from utility maps and other substantially reliable sources.
 - 2. Are offered separate from the Contract Documents as a general guide only without guarantees to accuracy.
- B. Examine the site and verify the location and elevation of all utilities and of their relation to the work. Existing utilities indicated on the site plans are for reference only and shall be field verified by the Contractor with the respective public or private utility.

1.14 CONTRACT DRAWINGS

- A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.
- B. It is the responsibility of the Contractor to compare the scale of all electrical drawings with the scale of the architectural drawings and make adjustments to all electrical drawings which have the incorrect drawing scale so that his material takeoffs are not in error due to an incorrectly labeled drawing scale and his proposal is complete.

1.15 ABBREVIATIONS AND DEFINITIONS

Abbreviations:

A/V	Audio/Visual
AWG	American Wire Gauge
BCR	Building Communications Room
CMP	Communications Media Plenum
CMR	Communications Media Riser
dB	Decibel
EMI	Electromagnetic Interference
ER	Equipment Room
ESS	Electronic Safety and Security
FACP	Fire Alarm Control Panel
FCR	Floor Communications Room
Hz	Hertz
IDF	Intermediate Distribution Frame
Km	Kilometer
LCD	Liquid Crystal Display
LED	Light Emitting Diode
M	Micron
MDF	Main Distribution Frame
MHz	Megahertz
NEXT	Near-End Cross Talk
nm	Nano-meter
OFN	Optical Fiber Non-conductive
OFNP	Optical Fiber Non-conductive Plenum
OFNR	Optical Fiber Non-conductive Riser
OTDR	Optical Time Domain Reflectometer
TC	Telecommunications Closet (<i>Now referred to as TR</i>)
TR	Telecommunications Room (<i>A.K.A. TC - Telecommunication Closet</i>)
UTP	Unshielded Twisted Pair Wire

Definitions:

Low Voltage Wire - Wire or cable used for one or more systems that operate on 24 volts or less. Low Voltage Wire is used to install and interconnect one or more of the ESS Systems. Low Voltage Wire includes patch cords, jumpers and all portions of cable or wire used to make the ESS Systems operational or for system communications.

Electronic Safety and Security Systems - One or more of the following and associated equipment: Fire Detection/Alarm Systems, Intrusion Detection/Alarm Systems, Access Control Systems, Video Surveillance Systems,

1.16 QUALITY ASSURANCE

- A. Equipment Standards:

1. System and all components shall be brand new stock from manufacturer.
 2. All electronics shall be 100% solid state.
 3. System and all components shall bear a UL Label.
- B. Contractor Qualifications:
At the time of Proposal, the Contractor shall:
1. Have manufactured, supplied or installed at least three (3) other systems of similar size, complexity, and general operation as the systems described in these specifications. The Contractor shall furnish in writing to Architect proof of compliance with this paragraph at the time of proposal.
 2. Hold all legally required Texas State Contractor's licenses necessary to accomplish the installation and activation of the described system at the facilities indicated. The Contractor shall submit copies of licenses to the Architect prior to the start of work
 3. Hold all legally required state registrations to meet local requirements for submittal drawings.
 4. Have a local office within fifty (50) miles of the project site staffed with factory trained technicians who have experience on systems of similar complexity and function as the systems described in these specifications. These technicians shall be fully capable of system engineering support, installation supervising, system start-up, and providing the Owner with training and service on both hardware and software for the systems specified.
 5. Certify complete and total compliance with the provisions of these specifications by letter or submittal of the proposal response forms, signed by an officer of the corporation, or a principal if other ownership currently exists. In addition, the letter or forms shall include a complete listing of exceptions, if any.

1.17 SUBMITTALS

- A. Provide SUBMITTALS according to Division 1 and the following.
- B. Requirements:
 1. Submit paragraph-by-paragraph specification review indicating compliance or deviation with explanation.
 2. Submit proof that all system components and cables are U.L. Listed.
 3. An equipment list with names of manufacturers, model numbers, and technical information on all equipment proposed. Clearly mark exact model number proposed to be installed.
 4. Product technical information sheets for each principal components in the proposed system, including cable, wire, terminal marking, and wire marking material.
 5. Certification from the manufacturer stating that the system Contractor is an authorized distributor or installer of the proposed system when such certifications exist.
 6. A statement listing every technical and operational parameter wherein the submitted equipment varies from that which was originally specified. If the submitter fails to list a particular variance and his submittal is accepted, but is subsequently deemed to be unsatisfactory because of the unlisted variance, the submitter shall replace or modify such equipment at once and without cost to the Owner.

1.18 EXAMINATION OF SITE

- A. The Contractor shall have visited the site and familiarized himself with all existing conditions prior to submitting his proposal and shall be prepared to carry out the work within the existing limitations. Failure or neglect to do so shall not relieve the Contractor of his responsibilities not entitle him to additional compensation for work overlooked and

- not included in his proposal.
- B. The Contractor shall confirm the availability of the proper power source for each piece of specified equipment, through site visits and Drawings as necessary. Where proper power does not exist, the Contractor shall provide the required power, circuits, outlets, conduits, and wire as specified under Division 26.

1.19 DATA ACCURACY

- A. Absolute accuracy of information regarding existing conditions cannot be guaranteed. The Drawings and Specifications are for the assistance and guidance of the Contractor and exact locations, distances, elevations, etc., shall be governed by actual field conditions. Where variations from the contract documents are required, such variations shall be approved by the Architect / Owner.

1.20 SECURITY

- A. The Contractor is responsible for complying with all of the Owner's and facility security's requirements to prevent theft or damage to equipment, tools and materials. If any deviation from facility security requirements is necessary, approval for such deviation shall be coordinated with the Owner.
- B. The Contractor shall not disclose any confidential information of the Owner. The Contractor acknowledges that such action is highly injurious and can do damage to the Owner. The Contractor will agree to and comply with the standard policies and provisions of the Owner regarding outside Contractors and Consultants.

1.21 UTILITIES

- A. It shall be the responsibility of the Contractor to provide all temporary connection and cables, lighting, light stands and power. The facilities shall be used in accordance with all applicable regulations regarding operations, safety and fire hazards of the governmental Authorities Having Jurisdiction, provided they are not used in a wasteful manner.

1.22 PERMITS

- A. All permits required for the specified performance and completion of the work shall be secured by the Contractor. These permits shall be presented and reviewed at the initial project progress meeting.

1.23 NOTIFICATION

- A. The Contractor shall not shut off any existing systems. The Contractor shall give the Owner at least ten (10) calendar day's notice of any requirements to shut off or interference with existing alarm, regulating, computer or other service systems. The Owner will arrange and execute any shutdown. All work such as splicing, connections, etc., necessary to establish or re-establish any system shall be completed by the Contractor in close coordination with the Owner.

1.24 INTERFERENCES WITH THE OWNER

- A. Transportation and storage of materials at the facility, work involving the facility, and all other matters affecting the habitual use by the Owner of its buildings, shall be conducted so as to cause the least possible interference, and at times and in a manner acceptable to the Owner. The Contractor shall make every effort to delivery equipment per the schedule required by the project.

1.25 PROJECT RECORD DOCUMENTS

- A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is significantly at variance with the

contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various major and minor feeders, equipment, and other pertinent items, as installed. Record underground and underslab cables installed, dimensioning exact location and elevation of such installations.

- B. At conclusion of project, obtain without cost to the Owner, electronic AutoCAD 2014+ / Revit CAD files of the original drawings and transfer as-built changes to these. Provide the following as-built documents including all contract drawings regardless of whether corrections were necessary and include in the transmittal: "2 sets of CDs and prints for Owner's use, one set of CDs, prints, and mylars for Architect / Engineers Records". Delivery of these as-built electronic, reproducible and prints is a condition of final acceptance.
1. 3 sets of electronic AutoCAD (2014+ dwg) / Revit CAD drawing files, on CD-ROM media, of each contract as-built drawing.
 2. One reproducible Dayrex mylar film positive of each contract as-built drawing.
 3. Three sets of blue or black-line prints of each contract as-built drawing.
- C. As-Built Drawings should indicate the following information as a minimum:
1. Indicate all addendum changes to documents.
 2. Remove Engineer's Seal, name, address, and logo from drawings.
 3. Mark documents AS-BUILT DRAWINGS.
 4. Clearly indicate: DOCUMENT PRODUCED BY:
 5. Indicate all changes to construction during construction. Indicate actual routing of all conduit and cables, etc that were deviated from construction drawings.
 6. Indicate exact location of all underground ESS raceways, and elevations.
 7. Correct schedules to reflect (actual) equipment furnished and manufacturer.
 8. During the execution of work, maintain a complete set of Drawings and specifications upon which all locations of equipment, devices, and all deviations and changes from the construction documents in the work shall be recorded.
 9. Exact location of all ESS equipment in building. Label panel schedules to indicate actual location.
 10. Exact location of all ESS equipment in and outside of the building.
 11. Location, size and routing of all ESS cables, conduits, equipment, etc. shall be accurately and neatly shown to dimension.
 12. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
 13. Cloud all changes.

1.26 OPERATING TESTS

- A. After all ESS systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect / Engineer and Owner. Provide minimum 24-hour advance notice of scheduling of all tests. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.27 WARRANTY

- A. All equipment shall be covered for the full manufacturers warranty period and systems shall be warranted by the Contractor for a period of two years commencing with the filing date of substantial completion. The Warranty shall cover all costs for warranty service, including parts, labor, prompt field service, pick-up, transportation, delivery, reinstallation, and retesting. A contract for service shall cover the period starting with the first expected

activation of each system and shall continue without interruption to cover the period to the end of the two-year warranty as defined above. The end of the warranty period shall be handled such that a smooth transition to a maintenance agreement with the Owner shall be achieved with no lapse in coverage.

- B. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.28 BUILDING CONSTRUCTION

- A. It shall be the responsibility of the sub-contractor to consult the Architectural and Engineering drawings, details and specifications and thoroughly familiarize himself as to the construction and all job-related requirements. All construction trades shall cooperate with the General Contractor / Construction Manager job site superintendent and lay out work so that all piping, cables, pathways, raceways, and other items are placed in the walls, furred spaces, chases, etc., so that there shall be no delay in the job.

1.29 TEMPORARY FACILITIES

- A. General: Refer to Division 01 for general requirements on temporary facilities.
- B. Temporary Wiring: Temporary power and lighting for construction purposes shall be provided under Division 26. Installation of temporary power shall be in accordance with NEC Article 305.
- C. Temporary facilities, wire, lights and devices are the property of this Contractor and shall be removed at the completion of the Contract.

1.28 EXTRA MATERIALS

- A. Keys: Provide three (3) sets of all keys for system cabinets.

PART 2 - PRODUCTS

2.1 WORK INCLUDED

- A. All materials listed in PART 2 - PRODUCTS of this Division Sections and on the Drawings shall be provided by the Contractor unless specifically excluded or modified in other portions of this Specification or Addendums.

2.2 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

- A. Materials, in general, shall conform to the National Electrical Code requirements and shall be listed, inspected, and approved by the Underwriters Laboratories and shall bear the UL label where labeling service is available. The label or listing of the Underwriters Laboratories, Inc. will be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this listing, the Contractor may submit a statement from a nationally recognized, adequately equipped testing agency, indicating that the items have been tested in accordance with required procedures, and that the materials and equipment comply with all Contract requirements.

2.3 STANDARD PRODUCTS

- A. Materials and equipment shall be the standard catalog products of manufacturers regularly engaged in the manufacture of products conforming to these specifications and shall essentially duplicate materials and equipment that have been in satisfactory use at least two (2) years prior to bid opening. Where custom or special items are required, these shall be fully described using drawings, material lists, etc., which fully describe in detail the item proposed for use on this project.

2.4 MANUFACTURE'S INSTRUCTIONS

- A. The Contractor is responsible for furnishing the proper Electronic Safety and Security

equipment and/or material and for seeing it is installed as intended by the manufacturer. The Contractor shall, wherever necessary, request advice and supervisory assistance from equipment manufacturers as required for the proper installation, operation, or start-up. The Contractor shall notify the Consultant, in writing, of any conflict between the Contract Documents and the manufacturer's recommendations and shall obtain, from the Consultant, instructions/direction before proceeding with the work. The Contractor shall pay for all costs resulting from deficiencies created by installation not in accordance with the manufacturer's recommendations or the instructions of the Consultant.

2.5 RUST PREVENTION

- A. Metallic materials shall be protected against corrosion. Exposed metallic parts of equipment exposed to the elements shall be given a rust inhibiting treatment and standard finish by the manufacturer. Components such as boxes, bodies, fittings, guards, and miscellaneous parts shall be protected in accordance with the ASTM A123 or A153, except where other equivalent protective treatment is specifically approved in writing.

2.6 STORAGE AT SITE

- A. The Contractor shall not receive material or equipment at the job site until ready for installation or until there is suitable space provided to properly protect equipment from rust, weather, humidity, dust, or physical damage.
- B. All electronic equipment, containing sealed lead acid batteries or gel cells, shall be stored in climate-controlled area until installed or reinstalled. Do not store in non-climate controlled connex storage units.
- C. Storage is to be provided and secured by the contractor. In the event that the Owner should agree to furnish storage space, security of the space and its contents shall remain the responsibility of the contractor.

2.7 CONDITION OF MATERIALS

- A. All materials required for the installation of the Electronic Safety and Security systems shall be new and unused. Any material or equipment damaged in transit from the factory, during delivery to premises, while in storage on premises, while being installed, or while being tested, until time of final acceptance, shall be replaced by this Contractor without extra cost to Owner.

2.8 NAMEPLATES

- A. Factory assembled components and equipment shall be provided with be factory stamped labeling. Labeling will have information required to specifically identify the component and/or equipment in the future such as the manufacturer's name, catalog number, serial number, etc. All data on the labels shall be legible at the time of final inspection.

2.9 ACCESS DOORS

- A. Wherever access is required in walls or ceilings to concealed junction boxes, pull boxes, equipment, etc., installed under this Division, furnish a hinged access door and frame with flush latch handle to another Division for installation. Doors shall be as follows:
 - 1. Plaster Surfaces: Milcor Style K.
 - 2. Ceramic Tile Surfaces: Milcor Style M.
 - 3. Drywall Surfaces: Milcor Style DW.
 - 4. Install panels only in locations approved by the Architect.

2.10 SPACE LIMITATIONS

- A. Equipment shall be chosen which shall properly fit into the physical space provided and shown on the drawings, allowing ample room for access, servicing, removal and

replacement of parts, etc. Adequate space shall be allowed for clearances in accordance with applicable codes and standards. Physical dimensions and arrangement of equipment shall be subject to the approval of the Consultant.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. This project has a critical path, which must be closely followed in order to meet the completion date. The Contractor shall review the proposed schedule at the Award of Contract meeting and be prepared to staff his work force according to the schedule constraints presented at that time.
- B. Aesthetics are an important consideration in this installation. All components shall be installed so as to have aesthetically pleasing results as determined by the Owner and Architect. Actual locations of all visible components shall be coordinated in advance with the Owner and Architect.
- C. Install, make fully operational and test the system as indicated on the Drawings and in the Specifications. Where information is not available the worst-case condition must be assumed to ensure a complete, functional system.
- D. Any interfacing with other systems shall be the Contractor's responsibility under this contract, and the details, both logical and physical, of such interfaces shall be reflected in the Submittals and As-Built drawings.
- E. If appropriate, interfaces with the Owner's Data Network or Telecommunications System shall be coordinated with the Owner and Architect.
- F. All necessary back boards, back-boxes, pull-boxes, connectors, supports, conduit, cable and wire shall be furnished and installed to provide a complete and reliable system. Exact location of all backboards, boxes, conduit and wiring runs shall be presented to the Owner / Architect for approval in advance of any installation. Provide as required and as specified in Division 26.
- G. Where required provide 120-VAC, 60 Hz power from nearest electrical panel through a junction box, to the system devices. Provide as required and as specified in Division 26.
- H. Where required, install conduit, cable and wire parallel and square with building lines, including raised floor areas. Conduit fills shall not exceed 40%.
- I. All equipment shall be mounted with sufficient clearance to minimize EMI as well as meet all applicable codes and facilitate observation and testing. Securely hand and/or fasten with appropriate fittings to ensure positive grounding, free of ground loops, throughout the entire system. Units shall be installed parallel and square to building lines.
- J. Quiet and vibration-free operation of all equipment is a requirement of this installation. Properly adjust, repair, balance or replace any equipment producing objectionable (in the judgment of the Owner or Architect) noise or vibration in any of the occupied areas of any building and provide additional brackets and bracing if necessary. Any such additions or changes shall be at no additional cost to the Owner.
- K. Installation shall comply with the CODES AND STANDARDS portion of this Section. Where more than one code or regulation if applicable, the more stringent shall apply.
- L. Where new equipment is replacing old equipment, the Contractor is responsible for removing and disposing of the old equipment and doing whatever repair work is necessary as specified by the Owner / Architect.
- M. Install firestopping, as specified in Division 26 for all penetrations in slabs and firewalls to meet code at the completion of work and prior to final testing demonstration to the Owner.
- N. The installation shall be performed in a professional manner.
- O. On a daily basis, clean up and deposit in appropriate containers all debris from work performed under the appropriate specification sections. Stack and organize all parts, tools and equipment when not being used.

- P. Preparation, handling and installation shall be in accordance with the Manufacturer's written instructions and technical data appropriate to the product specified.
- Q. All work shall conform to the National Electrical Contractor's Association "Standard of Installation" for general installation practice.
- R. At the conclusion of the installation, all work areas, including all enclosures and boxes, shall be vacuumed and cleaned to remove all debris and grease.

3.2 COORDINATION WITH OWNER / ARCHITECT

- A. Close coordination with the Owner / Architect is vital to achieve a complete, aesthetically pleasing job. The Contractor shall ensure that the Owner / Architect is kept fully apprized of job progress.

3.3 CUTTING, PAINTING, AND PATCHING

- A. Structural members shall not be drilled, bored or notched in such a manner that shall impair their structural value. Cutting of holes in structural members, if required, shall be done with core drills and only with the specific approval of the Owner / Architect for each instance.
- B. All walls that require cutting or repair during the installation process shall be returned to their original condition, including the matching of colors and finishes to the satisfaction of the Owner / Architect, and at no additional cost to the Owner.

3.4 WIRE AND CABLE

- A. All low voltage cable shall be low smoke plenum rated, limited energy, with 300-volt insulation.
- B. All wires in exposed areas shall run through conduit as specified in Division 26.
- C. Provide conduits, cable trays, raceways, wireways, boxes and outlets as specified in Division 26.
- D. After installation, and before termination, all wiring shall be checked and tested to insure there are no grounds, opens, or shorts on any conductors. In addition, all wires between buildings or underground and all coax cables shall have insulation tested with a megohmmeter (megger) and a reading of greater than 20 megohms shall be required to successfully complete the test.
- E. Run wires continuously from termination to termination without splices.
- F. Wire and cable shall be supported in each equipment and terminal cabinet and in each terminal and pull box in vertical risers and horizontal runs with wire duct and strap-type supports. At any point where wire duct is required for good wire management, whether shown on elevations or not, install appropriate duct. Where terminal boards are used, wire ducts shall be supplied on both sides and at no time shall wires cross over terminal boards. Arrange cables neatly to allow inspection, removal and replacement. Lace cables as required. Spot tie wire bundles with plastic cable ties and securely affix to panels. If screw type terminals are specified, terminal strip connections shall be locking, tongue style, pressure crimp, and solderless spade lug.
- G. Visually inspect wire and cable for faulty insulation prior to installation. Protect cable ends at all times with acceptable end caps except during actual termination. At no time shall any coaxial cable be subjected to a bend less than a 6-inch radius. Protect wire and cable from kinks. Install 1 pull rope for all 2" or larger sized conduits.
- H. Provide plastic bushings and strain relief material at all conduit exit points and where necessary, to avoid abrasion of wire and excess tension on wire and cable.
- I. Cables above accessible ceilings shall not rest on ceiling tiles. Use Velcro tie wraps, J-hooks or D-rings to hold cables. Provide independent support for all cables. Support is to be from building structure (do not support from pipes or conduits). ESS cables shall not tie off on HVAC supports, all-thread, ceiling grid hanger wire or electrical / mechanical

- piping system.
- J. Ground and bond equipment and circuits in accordance with NEC and Division 26.

3.5 IDENTIFICATION AND TAGGING

- A. All cables, wires, wiring forms, terminal blocks and terminals shall be identified by labels, tags to other permanent markings in accordance with TIA/EIA-606. The markings shall clearly indicate the function, source, or destination of all cabling, wiring and terminals. All cables and wires shall be identified, utilizing heat-shrink, machine printed, polyolefin wire markers (Brady Type B-32 *or equal*). Handwritten tags are not acceptable.
- B. Should a situation arise where the wire tagging format as shown on the drawings cannot be used, a substitute format shall be submitted which complies with the intent to provide documentation that will permit end-to-end tracing of all ESS Systems wiring.
- C. All panels shall be provided with permanently attached engraved lamacoid labels with identifying names and functions. All terminal points shall be appropriately labeled. Labels shall be consistent in form, color, and typeface throughout the system and all must contain the name of the system or subsystem as part of the label textual information. Design, color, font and layout shall be coordinated with, and approved by, the Owner.
- D. Identification of Equipment:
 - 1. All major equipment shall have a manufacturer's label identifying the manufacturer's address, equipment model and serial numbers, equipment size, and other pertinent data. Take care not to obliterate this nameplate. The legend on all nameplates or tags shall correspond to the identification shown on the Operating Instructions.
 - 2. A black-white-black 3-layer laminated plastic engraved identifying nameplate shall be permanently secured to each wireway, terminal cabinet, and ESS cabinet or rack.
 - a. Identifying nameplates shall have 1/2-inch high, engraved letters.
 - 3. Permanent, waterproof, black markers shall be used to identify each ESS grid junction box, clearly indicating the type of system available at that junction box.
 - 4. Pull Boxes: Field work each with a nameplate showing identity, and identifying equipment connected to it. Nameplates shall also indicate where pull box is fed from.
- E. Prohibited Markings: Markings intended to identify the manufacturer, vendor, or other source from whom the material has been obtained are prohibited for installation in public, tenant, or common areas within the project. Also prohibited are materials or devices that bear evidence that markings or insignias have been removed. Certification, testing (example, Underwriters Laboratories), and approval labels are exceptions to this requirement.
- F. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of ESS facilities. Provide text of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with industry standards for color and design.
- G. Wire and Cable Labeling: Provide wire markers on each conductor in all boxes, pull boxes, gutters, wireways. Identify with drop/circuit number.
- H. Underground Warning Tape: Thomas and Betts or approved equal. Six-inch wide plastic tape, colored red or orange with suitable warning legend describing buried ESS lines. All underground conduits shall be so identified. Tape shall be buried at a depth of 6-inches below grade and directly above conduits or ductbanks. Provide magnetic marking tape below all underground conduits.

3.6 CUTTING AND PATCHING

- A. General: Comply with the requirements of Division 01 for the cutting and patching of other work to accommodate the installation of electrical work. Except as authorized by

the Architect / Engineer, cutting and patching of electrical work to accommodate the installation of other work is not permitted.

3.7 INSTRUCTION OF OWNER'S PERSONNEL

- A. Before proceeding with the instruction of Owner Personnel, prepare a typed outline, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.
- B. Prior to substantial completion, conduct an on-site training program to instruct Owner's operating personnel in the operation and maintenance of the ESS systems.
 - 1. Provide the training during regular working day.
 - 2. The Instructors shall be experienced in their phase of operation and maintenance of the electrical systems and with the project.
- C. Time to be allocated for instructions.
 - 1. Minimum of 12 hours dedicated instructor time
 - 2. 4 hours on each of 3 days
 - 3. Additional instruction time for specific systems as specified in other Sections.
- D. Before on-site training, submit the program syllabus; proposed time and dates; for review and approval, minimum 48 hours prior to proposed training time and date.
 - 1. One copy to the Owner
 - 2. One copy to the Architect / Engineer
- E. The Owner shall provide a list of personnel to receive instructions and shall coordinate their attendance at the agreed upon times.
- F. Use operation and maintenance manuals as the basis of instruction. Review manual with personnel in detail. Explain all aspects of operation and maintenance.
- G. Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, maintenance, and shut down of each item of equipment.
- H. Demonstrate equipment functions (both individually and as part of the total integrated system).
- I. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.
- J. Submit a report within one week after completion of training. List time and date of each demonstration, hours devoted to the demonstration, and a list of people present, with their respective signatures.
- K. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.
- L. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.8 OPENINGS

- A. Framed, cast or masonry openings for boxes, equipment or conduits are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.9 OBSTRUCTIONS

- A. The drawings indicate certain information pertaining to surface and subsurface obstructions, which has been taken from available drawings. Such information is not

guaranteed, however, as to accuracy of location or complete information.

1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
 2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
- B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.10 VANDAL RESISTANT DEVICES

- A. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used.
- B. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.11 PROTECTION

- A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.
- B. Do not deliver equipment to this project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather shall be rejected, and the contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

3.12 EQUIPMENT BACKBOARDS

- A. Backboards: ¾ inch, fire retardant, exterior grade plywood, painted gray, both sides.
1. Provide minimum of two 4-ft. by 8-ft. sheets of plywood for each location shown.
 2. Provide minimum of two 4-ft. by 4-ft. sheets of plywood for each ESS location.

3.13 SITE MANAGEMENT RESPONSIBILITY

- A. The Contractor shall provide an on-site Project Manager as defined in CONTRACTOR'S QUALIFICATIONS portion of this Section.

3.14 DEMOLITION AND RELOCATION

- A. The Contractor shall modify, remove, and relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain as directed by the Owner. Materials and items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to the approval of the Owner. The Contractor may substitute new materials and items of like design and quality in lieu of materials and items to be relocated, if approved by the Owner.
- B. All items scheduled for relocation and/or reuse shall be inspected by the Contractor and the Owner or his authorized representative. A written report of the condition of each item shall be made and provided to the Consultant. Where items scheduled for relocation and/or reuse are considered unsuitable for reuse, the Contractor shall so notify the Consultant and await reinstallation instructions before proceeding with removal. Items damaged in reinstallation shall be repaired or replaced by the Contractor as directed by the Owner at no additional cost to the Owner or the Consultant.
- C. All items which are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean, repair,

and provide all new materials, fittings, and appurtenances required to complete the relocation and to restore the items to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.

- D. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points as indicated on the drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied off or connections into the existing facilities in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific written approval of the Consultant.

3.15 EXISTING SYSTEM TESTING

- A. Contractor shall have each low voltage system tested prior to the commencement of construction. Systems shall include all systems that fall under the Division 28 umbrellas, as identified in the Division 2 of the Construction Specifications Institute (CSI) current Master Format7 Test shall include the functionality of all field devices and equipment. Any failures or items found to be functioning not to specification, shall be reported prior to construction. Any items found to be improperly or non-functioning upon the completion of the project, shall be replaced and/or repaired, by the contractor, at no additional cost to the project or the owner.
- B. Contractor shall document the location and any ID tag, MAC address, IP address, or bar code of any existing device that is to be removed from its current location. Devices that are to remain, shall be reinstalled in the exact location that they reside in prior to construction, unless noted otherwise.
- C. Any individual/firm that will be removing, relocating, reinstalling, or tampering with any devices; shall be licensed by the state and certified by the manufacturer of the system.
- D. Contractor shall remove any devices where construction occurs to prevent possible damage to the device. Removal of any devices which support user connection or other systems, shall be coordinated with the owner prior to removal and/or taking offline.

3.16 START-UP RESPONSIBILITY

- A. The Contractor shall initiate System operation. The Contractor shall provide competent Start-Up personnel on each consecutive working day until all ESS Systems are functional and ready to start the acceptance test phase. If the Contractor, in the Owner / Architect's judgment, is not demonstrating progress in solving any technical problems, the Contractor shall supply Manufacturer's factory technical representation and diagnostic equipment at no cost to the Owner, until resolution of those defined problems. Where appropriate, the Contractor shall bring the Systems on-line in their basic state (i.e., alarm reporting, facility code access control, etc.) It is the responsibility of the Owner to provide the specific database information that will be utilized for initial system programming.
- B. Properly ground each piece of electronic equipment prior to applying power. Properly ground all shielded wire shields to the appropriate earth ground at the hub end only, not at the remote or device end.
- C. Use a start-up sequence that incrementally brings each portion of the system on-line in a logical order that incorporates checking individual elements before proceeding to subsequent elements until the entire system is operational. The basic steps should include:
 - 1. Establish ground planes at the equipment rooms and hub end of the systems as specified in Division 26.
 - 2. Disconnect power, connect the first device, reconnect power, and verify operational correctness. Repeat until the entire system is verified and

operational.

3.17 PREPARATION FOR ACCEPTANCE (SUBSTANTIAL COMPLETION)

- A. All systems, equipment, and devices shall be in full and proper adjustment and operation, and properly labeled and identified.
- B. All materials shall be neat, clean and unmarred, and parts securely attached.
- C. All extra material as specified shall be delivered and stored at the premises as directed.
- D. Test reports of each system and each system's components and As-Built Project Drawings shall be complete and available for inspection and delivery as directed by the Owner.

3.18 SYSTEM ACCEPTANCE REQUIREMENTS

- A. Before final acceptance or work, the Contractor shall perform and/or deliver each of the following in the order stated.
- B. The Contractor shall deliver three (3) composite "System Operations and Maintenance" manuals in three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain in appropriately tabbed sections:
 - 1. A statement of Guarantee including date of termination and the name and phone number of the persons to be called in the event of equipment failure.
 - 2. A set of Operating procedures for the overall System that includes all required Owner activities, and that allows for the Owner operation of all attributes and facilities of the System.
 - 3. A section for each specific type of equipment containing the vendor manuals, instruction sheets, and any related literature that came in the original shipping container for that piece of equipment. Include all warranty cards.
- C. Testing:
 - 1. The Contractor shall perform all tests required by Division 28 and those submitted as part of this Section.
 - 2. The Contractor shall activate all devices for proper system operation, including supervisory and trouble circuit tests. Similarly, audible alarms will not be activated except on a one-time, coordinated basis, to check the actual sounding devices.
 - 3. A test report for each piece of equipment shall be prepared by the Contractor and submitted to the Owner. This report shall include a complete listing of every device, the date it was tested, by whom and the results. The final test reports shall indicate that every device tested successfully. Failure to completely test and document the tests will result in a delay of final testing and acceptance.
- D. As-Built Drawings:
 - 1. After completion of all the tests listed above, and prior to the final acceptance test, The Contractor shall submit the complete As-Built drawings as identified in PART 1 – PROJECT RECORD DRAWINGS.
 - 2. The final As-Built Drawings shall consist on one set of reproducible prints, two (2) sets of Point-to-Point Detail Drawings, Equipment Schedules, and the complete detailed technical data that was shipped by the manufacturer with all installed equipment.
- E. Final Acceptance Test: The Final Acceptance Test shall demonstrate the installed and activated System's performance and compliance with System Specifications. However, before this testing can begin the following must have received and reviewed by the Owner.
 - 1. System Operations and Maintenance Manuals
 - 2. System Test Reports
 - 3. As-Built Drawings

3.19 NOTICE OF COMPLETION

- A. When the Final System Acceptance Requirements described above including the Final Acceptance Test described above have been satisfactorily completed. The Owner / Architect shall issue a Letter of Completion to the Contractor indicating the date of such completion. The Notice of Completion shall be recorded by the Contractor upon receipt of the Owner / Architect completion letter. This date of record shall be the start of the warranty period.

END OF SECTION

SECTION 28 0507
SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Prepare submittals as required by Division 1 and as outlined below.
- B. Submit product data shop drawings only for the following and for items specifically requested elsewhere in the Contract Drawings and Specifications. Architect / Engineer reserves the right to refuse shop drawings not requested for review and to imply that materials shall be provided as specified without exception.
- C. The term submittal, as used herein, refers to all:
 - 1. Shop Drawings
 - 2. Coordination Drawings
 - 3. Product data
- D. Submittals shall be prepared and produced for:
 - 1. Distribution as specified
 - 2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

- A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
- B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.
- C. Identify field dimensions; show relation to adjacent or critical features or work or products.

1.3 COORDINATION DRAWINGS

- A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: 1/4"=1'-0".
- B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
- C. For each room containing ESS equipment and each rack with ESS equipment, submit plan and elevation drawings. Show:
 - 1. Actual ESS equipment and components to be furnished.
 - 2. NEC working space and NEC access to NEC working space.
 - 3. Relationship to other equipment and components and openings, doors and obstructions
 - 4. Rack location and dimensions
- D. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- E. Verify location of ESS station devices and other work specified in this Division.
 - 1. Coordinate with drawing details, site conditions and millwork shop drawings prior to installation.
 - 2. Where required for clarification, submit shop drawings prior to rough-in and fabrication.
- F. Submit shop drawings in plan, elevation and sections, showing outlets and other devices in casework, cabinetwork and built-in furniture.

1.4 PRODUCT DATA

- A. All product options specified shall be indicated on the product data submittal. All options listed on the standard product printed data not clearly identified as not part of the product

data submitted shall become part of the Contract and shall be provided.

- B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.
- C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.
- D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
- E. Mark up a copy of the specifications for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer/Owner (Does Not Comply, Explanation:)

1.5 MANUFACTURERS INSTRUCTIONS

- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up and adjusting.

1.6 CONTRACTOR RESPONSIBILITIES

- A. Review submittals prior to transmittal.
- B. Determine and verify:
 - 1. Field measurements
 - 2. Field construction criteria
 - 3. Manufacturer's catalog numbers
 - 4. Conformance with requirements of Contract Documents
- C. Coordinate submittals with requirements of the work and of the Contract Documents.
- D. Notify the Architect / Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
- E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.
- F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.
- G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect / Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.
- H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
 - 1. Proper sizes and capacities
 - 2. That the item will fit in the available space in a manner that will allow proper service
 - 3. Construction methods, materials and finishes
- I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.7 SUBMISSION REQUIREMENTS

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.
- B. Number of submittals required:
 - 1. Shop Drawings and Coordination Drawings: Submit four opaque reproductions.

2. Product Data: Submit the number of copies the contractor requires, plus those to be retained by the Architect / Engineer.
- C. Accompany submittals with transmittal letter, in duplicate, containing:
1. Date
 2. Project title and number
 3. Contractor's name, address and telephone number
 4. The number of each Shop Drawing, Project Datum and Sample submitted
 5. Other pertinent data
- D. Submittals shall include:
1. The date of submission
 2. The project title and number
 3. Contract Identification
 4. The names of:
 - a. Contractor
 - b. Subcontractor
 - c. Supplier
 - d. Manufacturer
 5. Identification of the product
 6. Field dimensions, clearly identified as such
 7. Relation to adjacent or critical features of the work or materials
 8. Applicable standards, such as ASTM or federal specifications numbers
 9. Identification of deviations from contract documents
 10. Suitable blank space for General Contractor and Architect / Engineer stamps
 11. Contractor's signed and dated Stamp of Approval
- E. Coordinate submittals into logical groupings to facilitate interrelation of the several items.
1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
 2. Associated items requiring correlation for efficient function or for installation

1.8 SUBMITTAL SPECIFICATION INFORMATION

- A. Every submittal document shall bear the following information as used in the project manual:
1. The related specification section number
 2. The exact specification section title
- B. Submittals delivered to the Architect / Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.9 RESUBMISSION REQUIREMENTS

- A. Make resubmittals under procedures specified for initial submittals.
1. Indicate that the document or sample is a resubmittal
 2. Identify changes made since previous submittals
- B. Indicate any changes which have been made other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

- A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
- B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect / Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar

data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

- C. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's stamp of approval and signature.
- D. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

- A. The Architect / Engineer will:
 - 1. Review identified submittals with reasonable promptness and in accordance with schedule. Specific equipment submittals that may be required to be expedited shall be submitted separately without other submittal items not requiring the same prompt attention.
 - 2. Affix stamp and initials or signature, and indicate requirements for resubmittal or approval of submittal
 - 3. Return submittals to Contractor for distribution or for resubmission
- B. Review of submittals will not extend to design data reflected in submittals that is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.
- C. Architect / Engineer's review is only for conformance with the design concept of the project and for compliance with the information given in the contract.
 - 1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
 - 2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.
- D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

- A. Do not make requests for substitution employing the procedures of this Section.
- B. The procedure for making a formal request for substitution is specified in Division 01.

PART 2 - PRODUCTS - NOT USED.

PART 3 - EXECUTION

3.1 SHOP DRAWINGS AND PRODUCT DATA

- A. Submittals shall not be combined or bound together with any other material submittal.
- B. Submit individually bound shop drawings and product data for the following when specified or provided:
 - 1. Low Voltage Wire
 - 2. Electronic Access Control and Intrusion Detection
 - 3. Electronic Surveillance
 - 4. Fire Detection and Alarm

3.2 COORDINATION DRAWINGS

- A. Submit coordination drawings as specified.

END OF SECTION

**SECTION 28 0510
CONTRACT QUALITY CONTROL**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.2 QUALITY CONTROL PROGRAM

- A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes to match approved samples; all exposed finishes shall be approved by the Architect / Engineer. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide a manufacturer's qualified personnel to observe:
 - 1. Field conditions.
 - 2. Condition of installation.
 - 3. Quality of workmanship.
 - 4. Start-up of equipment.
 - 5. Testing and adjusting of equipment.
- B. Manufacturer's qualified personnel shall make written report of observations and recommendations to Architect / Engineer.

1.7 MOCK UPS

- A. Assemble and erect the specified equipment and products complete, with specified anchorage and support devices, seals and finishes.
- B. Do not proceed with any work involving a mock-up, until the related mock up has been approved in writing.
- C. Acceptable mock-ups in place shall be retained in the completed work where possible.
- D. Perform tests and submit results as specified.

1.8 SCHEDULING OF MOCK-UPS

- A. Schedule demonstration and observation of mock-ups, in phases, with Architect / Engineer.

1. Rough-in
2. Finish with all appurtenances in place
3. Demonstrations

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS

PART 3 - EXECUTION

3.1 ADJUSTMENTS AND MODIFICATIONS

- A. Contractor shall provide all adjustments and modifications as requested by the manufacturer's qualified personnel at no additional cost to Owner.

3.2 MOCK-UPS

- A. Mock up a typical classroom, science lab of each type, and computer lab with all wiring devices, cover plates, rough-in boxes, conduits, etc. provide all conductors from all wiring devices to above ceiling space to demonstrate conduit routing and conductor fill.

END OF SECTION

**SECTION 28 0550
FIRESTOPS**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide firestop as required, and as specified. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.
- B. Types: Firestop required for the project includes smokestop.

1.2 QUALITY ASSURANCE

- A. UL Label: Firestops shall be UL labeled.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Nelson.
- B. 3M (Minnesota Mining Manufacturing).
- C. Hilti
- D. Specified Technologies, Inc.

2.2 MATERIAL AND COMPONENTS

- A. General: Except as otherwise indicated, provide firestop manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by the manufacturer, and as required for installation.

2.3 FIRESTOP

- A. Conduits: Provide a soft, permanently flexible sealant for 1-1/2 to 2 hour rated fireproofing for steel conduits (up to 4" diameter).
- B. Low Voltage Cables, Fiber Optic Cable and Innerduct: Provide Specified Technologies, Inc. EZ-Path single, double, or triple pathways as required.

PART 3 - EXECUTION

3.1 INSTALLATION OF FIRESTOPS

- A. General: Install firestops in accordance with the manufacturer's installation instructions and industry practices to ensure that the firestops comply with requirements. Comply with UL and NFPA standards for the installation of firestops.

END OF SECTION

SECTION 28 1000
ACCESS CONTROL SYSTEM (ACS)

PART 1 - GENERAL

1.1 RELATED WORK

- A. The following, in their entirety and as applicable, shall apply to this section. Including any associated drawings.
 - 1. Conditions of the Contract
 - 2. Division 1
 - 3. Division 26
 - 4. Division 27
 - 5. Division 28

1.2 WORK INCLUDED

- A. The Contractor shall furnish and install a complete microprocessor-based access control system as specified herein. The system shall include, but not be limited to, all control equipment, power supplies, power circuits, signal initiating and signaling devices, conduit, wire, fittings, and all other accessories required to provide a complete and operable system.
- B. Security system devices indicated are for reference and coordination purposes only. The System Installer shall design and provide a complete system, meeting the requirement of specification. The installer shall provide all security system devices required for complete system perimeter coverage acceptable to all governing authorities, Architect and Owner.
- C. The system shall include security card access interfaces at all locations noted.
 - 1. The Control System shall be the product of a single manufacturer.
 - 2. Tag all conductors or cables at each end.
 - 3. Installation of modules and Cards.
 - 4. Interconnection of security panels.
 - 5. Installation of new security devices
 - 6. Integration with existing Intrusion Detection and CCTV as required by owner.
 - 7. Preconstruction meeting with Owner's personnel, installing technician and project superintendent.
 - 8. Installation of all Card Readers and field devices
- D. The contractor shall connect this location to the district ACS Management system.
- E. Prior to rough-in or installation of any access control device, Contractor will be required to attend a pre-construction meeting with the Door Hardware installer to aid in coordination and help avoid gap / overlap during the installation phase.
- F. Contractor must be in good standing with the district and have no outstanding performance or warranty items at the time of bid. Any outstanding items or issues is grounds to disqualify the Contractor's bid
- G. All structured cabling for data connections for door controllers and vestibule panel to connect to the owner's LAN shall be installed by the structured cabling contractor. Exact location of door controllers will be coordinated between Contractor and the structured cabling contractor.
- H. All power circuits, conduits, penetrations and sleeves required to complete installation of the control system shall be installed by the electrical contractor. Coordination meeting(s) between Contractor and electrical contractor will be required to facilitate installation of conduits, pathways, and power circuits. (Ref. 28-13-00 2.6.A.4 & 28-13-00 2.6.A.5)
- I. The documents issued for this project are conceptual in nature, including but not limited to specifications and drawings. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer's shop drawings and product data submittals shall represent a complete system, and documents accepted do

not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project's Technology Consultant and the Owner.

- J. System Installer to refer to Division 08 Door Hardware Specification. Provide and install all hardware specified to be provided by the "Access Control Contractor", "Security Installer", "Division 28", or any variation thereof.
- K. System Installer to provide and install door hardware as specified in Specification Section 28 10 00.05 Door Intercom System.
- L. Reference Attachment 'A' of this specification for supplemental scope and product material list as it relates to the project and the Owner standards.

1.3 REFERENCES

- A. Code of Federal Regulations (CFR).
- B. Institute of Electrical and Electronics Engineers (IEEE):
 - 1. 802.3 Ethernet Standards.
 - 2. IEEE 1100 Recommended Practice for Powering and Grounding Electronic Equipment.
- C. International Electrotechnical Commission (IEC).
- D. International Organization for Standardization (ISO):
 - 1. ISO / IEC 10918 - Information technology -- Digital compression and coding of continuous-tone still images: Requirements and guidelines; JPEG.
 - 2. ISO / IEC 14496-10 - Information Technology - Coding Of Audio-Visual Objects - Part 10: Advanced Video Coding; MPEG-4 Part 10 (ITU H.264).
 - 3. ISO / IEC 23008-2 - High Efficiency Coding and Media Delivery In Heterogeneous Environments - Part 2: High Efficiency Video Coding; MPEG-H Part2 (ITU H.265, HEVC).
- E. Federal Communications Commission (FCC):
 - 1. FCC Part 15 – Radio Frequency Device
- F. Underwriters Laboratories (UL):
 - 1. UL294 – Access Control Systems Units
- G. Electronic Industries Alliance (EIA)
 - 1. RS485 - Electrical Characteristics of Generators and Receivers for use in Balanced Digital Multi-Point Systems
- H. Federal Information Processing Standards (FIPS)
 - 1. Advanced Encryption Standard (AES) (FIPS197)
 - 2. FIPS201-2: Open Options DNA Fusion FIPS in conjunction with an E2-SSP-D2-FIPS, NSC-100-FIPS, RSC-2-FIPS and other listed components will provide an access control solution that is fully FIPS 201-2 compliant.
 - 3. Personal Identity Verification (PIV) of Federal Employees and Contractors
- I. Homeland Security Presidential Directive 12 (HSPD12)
- J. National Fire Protection Association Standards:
 - 1. NFPA 70 - National Electrical Code
 - 2. NFPA 72 - National Fire Alarm Code
 - 3. NFPA 101 - Life Safety Code
- K. RoHS compliant
- L. SIA AC-01-1996.10 - Access Control - Wiegand
- M. Local & State Building Codes
- N. Requirements of Local Authorities having Jurisdiction
- O. Requirements of American Disabilities Act (Public law 101-336).
- P. Texas Accessibility Standards (TAS)
- Q. Texas Insurance Code.

1.4 QUALITY ASSURANCE

- A. System Installer Qualifications:
1. The System Installer shall be the authorized representative of the Access Control Manufacturer to sell, install, and service the proposed manufacturer's equipment. The System Installer shall have represented the security alarm manufacturer's product for at least two years.
 2. The System Installer shall be licensed as required, by the State in which the project is located in, as a security services contractor to design, sell, install, and service security alarm systems.
 3. The System Installer shall provide 24-hour, 365 days per year emergency service with factory trained service technicians.
 4. The installing firm shall have personnel on their staff that has been actively engaged in the business of designing, selling, installing, and servicing security alarm systems for at least ten (10) years.
 5. The System Installer must submit to the owner prior to starting any work the factory training certificates for all personnel that will be working on the access control system. No person is allowed to work on the system without proper manufacturer's certification.
 6. The proposing System Installer for this system and the installer of this system shall be of the same organization. Absolutely no subcontracting of any portion of this system by the proposing System Installer will be allowed.
 7. The proposing/installing contractor of this system must be an authorized dealer / integrator for the project's specified Video Surveillance and the Intrusion Detection systems as well as the system specified in this section.
 8. For proper, smooth, and complete integration of the IP security camera, access control, and intrusion detection systems; the proposing/installing contractor of the video surveillance and intrusion detection systems must be the same contractors.
 9. The System Installer must be a current integrator of solution in the closest major metropolitan area marketplace, have a permanent office located within 75-miles of the project, and be able to include information on current support staff to be able to service this client.
 10. The System Installer must be in good standing with the Owner and have no outstanding performance or warranty items at the time of bid. Any outstanding items or issues is grounds to disqualify the System Installer for performing any work on the project.

1.5 SUBMITTALS AND CLOSE-OUT

- A. Product Data: Within fourteen (14) days of Notice to Proceed, the system installer shall furnish the following in a single consolidated submittal:
1. Permits: The Contractor shall obtain all required permits and provide copies to the Owner / Architect / Engineer.
 2. Product Literature: Complete manufacturer's product literature for all system equipment, power supplies, cable, termination components, cable supports, cable labels, field devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner/Designer) and the manufacturer's supporting documentation, demonstrating compatibility with other related products shall be included. The submittal shall have some type of distinguishing marker or pointer to indicated what specific product is to be submitted.
 3. Construction Schedule: A time-scaled Construction Schedule indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
 4. Specification Compliance: A letter shall be provided stating, by section and

- subsection, that the system installer complies with the ENTIRE specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been accepted by the project's technology consultant.
5. Certifications: The System Installer shall submit all of the following certifications and the certifications must contain dates which are valid from the date of proposal and not expire any sooner than 12 months after substantial completion of the project.
- a. Manufacturer's Authorized Dealer/Installer Certification: This certification must be held by the proposing/installing contractor and state that the proposing/installing contractor is and authorized dealer/installer of the system specified within the project specifications. The certification must have been obtained by the office that is within a 75-mile radius of the project's location.
 - b. Installer Certification: This certification must be held by at least 25% of the, on-site, staff and be made available at the site if requested by the owner, architect, and/or project's technology consultant.
 - c. Licenses: This includes all licenses required by the state in which the work is being performed, the federal government, local authorities having jurisdiction, and any organization in that governs the specific system
- B. Shop Drawings: Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
1. Proposed circuit routing and circuit grouping plan prepared by a system registered designer. The designer's certification must be current. Identifiable, separate routing shall be shown for both the station cabling and any backbone trunk cabling.
 2. In addition to the cable routing, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:
 - a. Location of all control equipment and remote power sources
 - b. Locations of all field devices and outlets
 - c. Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)
 - d. Location of sleeved wall and/or floor pass-thru
 - e. Size of sleeve at each location installed
 - f. Quantity of cable passing through each sleeve
 - g. Conduit routing, size, quantity, and stub-up locations for any floor mounted outlets or outlets installed in casework.
 3. Drawing Compliance: A letter shall be provided stating that the system installer complies with the entire project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the project's technology consultant.
- C. Close-out Procedures: For review and acceptance, furnish an electronic copy of the following documents to the Architect / Engineer. Upon acceptance of the submitted close-out documents, provide four (4) copies on an electronic storage media (CD or USD Flash Drive) Labeled with the project name, date of submission, and the name of the submitting firm. Final copies shall be delivered directly to the project's Technology Consultant. The closeout submittals shall include the following and be packaged in a storable container with the physical storage media and any physical items listed:

1. Inspection and Test Reports: During the course of the Project, the System Installer shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed, conform to contract requirements. The System Installer shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The System Installer shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
2. Provide complete test reports for all cabling and devices that comprise system as outlined in this document.
3. Include the Name, address and telephone of the authorized factory representative with a 24-hour emergency service number.
4. The manual shall also include Manufacturer's data sheets and installation manuals/instructions for all equipment installed and a list of recommended spare parts.
5. Generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement.
6. An up-to-date record ("as-built") set of approved shop drawing prints that have been revised to show each and every change made to the system from the original approved shop drawings.
7. As-built Drawings shall include cable pathways; device locations with correct labeling, control equipment locations, remote power supply locations, cross connect locations, and lightning protection locations. The as-built drawings shall be prepared using AutoCAD 2014 or later.
8. All drawings must reflect point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system.
9. A copy of the manufacturer's warranty on the installed system.
10. Any keys to cabinets and/or equipment and special maintenance tools required to repair, maintain, or service the system.
11. Operating and Maintenance Instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction, and shall be provided to the Owner, for their use, in a three-ring binder labeled with the project name and description. (4 copies)
12. Upon completion of the work and at a time designated by the Architect or owner, provide formal training sessions for the Owner's operating personnel to include location, operation, and maintenance of all included systems and equipment. Provide a video copy of the training session as well as all sign in and training sign off sheets
13. One (1) 30" x 42" laminated floor plan sheets illustrating device locations, system wiring configuration, and cable designation. The System Installer shall provide one complete floor plan sheet at each panel location.

1.6 DEFINITIONS

- A. Abbreviations:
1. ACS Access Control System
 2. VMS Video Management System
 3. NVR Network Video Recorder
 4. IDS Intrusion Detection System
 5. GUI Graphical User Interface
 6. IP Internet Protocol
 7. CR Card Reader

- 8. DS Door Station
- 9. MS Master Station
- 10. PIR Passive Infrared Sensor
- 11. LD Lockdown
- 12. MDF Main Distribution Frame
- 13. IDF Intermediate Distribution Frame

B. Definitions:

- 1. Access Card: A coded employee card, usually the size of a credit card, recognizable to the access control system and read by a reader to allow access. It can be used for photo identification of the cardholder and for other data collection purposes. Card technologies include magnetic strips, Wiegand-effect, proximity (active/passive), barium ferrite, smart/intelligent cards, and NFC enabled applications on mobile devices.
- 2. Access Control System: An interconnected set of controllers, managing the entrance and exit of people through secured areas.
- 3. Access Level: The door or combination of doors and/or barriers an individual is authorized to pass through and the times they are permitted.
- 4. Anti-Pass back (Anti-Tailgating): This feature protects against more than one person using the same card or number. It defines each system card reader and card ID number as IN, OUT or other. Once a card is granted access to an IN reader, it must be presented to an OUT reader before another IN reader access is granted. Cards will continue to have access to all authorized OTHER readers.
- 5. Alarm: A signal that indicates a problem.
- 6. Alarm input: A device that is monitored by the access control panel. An alarm signal will be generated if the device is activated.
- 7. Badge: Badge is a template or a design for creating a card. DNA Fusion includes a full-featured badge layout utility for designing, creating, and printing badges. Badge design includes magnetic stripe encoding, bar coding, signatures, and so on.
- 8. Bar Code: A method of encoding information using lines and blank spaces of varying size and thickness to represent alphanumeric characters.
- 9. Biometrics: A general term for the verification of individuals using unique biological characteristics (i.e. fingerprints, hand geometry, voice analysis, the retinal pattern in the eye).
- 10. Card and Card Holder: A card is an identity proof of a person and a card holder is a person who holds the card. Multiple cards can be assigned to a single card holder to provide different access.
- 11. Controller: A microprocessor-based circuit board that manages access to a secured area. The controller receives information that it uses to determine through which doors and at what times cardholders are granted access to secure areas. Based on that information, the controller can lock/unlock doors, sound alarms, and communicate status to a host computer.
- 12. Card Reader: A device that retrieves information stored on an access card and transmits that information to a controller.
- 13. Digital Video Recorder: A security system device that records the video from the surveillance cameras (IP and Analog) on a hard disk.
- 14. Door: A generic term for a securable entry way. In many access control applications, a "door" may be a gate, turnstile, elevator door, or similar device.
- 15. Duress: Forcing a person to provide access to a secure area against that person's wishes.
- 16. Input: An electronic sensor on a controller that detects a change of state in a device outside the controller.
- 17. Integrated lockset: An integrated, intelligent locking solution that typically runs on

batteries, but can be externally powered, that contains most of the door components, i.e. reader, door contact, and request to exit in a single, mountable unit.

18. Keypad: An alphanumeric grid which allows a user to enter an identification code. A flat device which has buttons that may be pressed in a sequence to send data to a controller, and which differs from a typewriter-like computer keyboard.
19. Output Relay: A device that changes its state upon receiving a signal from a controller. Typically, the state change prompts an action outside of the controller such as activating or deactivating a device. The auxiliary relays found in access control panels or NODES that control external devices.
20. Shunt Time: The length of time a door open alarm is suppressed (shunted) after a valid card access or free egress request. This time should be just enough to allow a card user to open a door or gate, pass through, and then close it.
21. Time Schedules: Schedules that allow cards to function or not function depending on the time of day. This is used to limit access to the facility. The schedule may include not only time but which days of the week a card is valid.
22. Video Management System: An enterprise-class video management and storage solution

1.7 PRE-INSTALLATION MEETINGS

- A. No less than a minimum of two weeks prior to rough-in or installation of any access control device, the ACS Installer will be required to attend a pre-construction meeting with the Door Hardware provider / installer to aid in coordination and help avoid gap / overlap during the installation phase.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.
- B. Handling: Handle materials to avoid damage.

1.9 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.10 SEQUENCING

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.11 WARRANTY

- A. The ACS furnished by the System Integrator including wiring, software, hardware and third-party products shall be fully warranted for parts, materials and labor for a minimum of 1 year from date of the final acceptance.
- B. Manufacturer shall provide a limited 3-year warranty for the product to be free of defects in material and workmanship.

PART 2 - PRODUCTS

2.1 Reference Attachment 'A' of this specification for supplemental scope and product material list as it relates to the project and the Owner standards

2.2 MANUFACTURERS

- A. Approved Manufacturers:
 1. AMAG Technology Inc.

20701 Manhattan Place
Torrance, Ca 90501
(310).518.2380
<http://www.amag.com>

- B. Requests for substitutions will be considered in accordance with provisions of Division 1. In the absence of direction by Division 1, substitution request must be submitted no less than ten (1) business days from the time of proposal. Any substitution proposed will have to be proposed as a complete system replacement across the Owner's entire platform, including any cabling and/or hardware changes required to convert all of the Owner's existing sites.

2.3 SERVERS AND USER INTERFACE

- A. Servers and User Interfaces are existing to remain. The system installer shall coordinate the installation of all new equipment and/or existing equipment that is affected by the project's scope. All equipment shall be modified and/or added in compliance with the existing systems parameters. The system installed shall provide and additional equipment to furnish a complete expansion of the system as shown on the project drawings, access control schedule, details, and legends.

2.4 ACCESS CONTROL SYSTEM (ACS)

- A. General: The ACS is a modular and networked based system providing physical access control security to a Wide Area campus enterprise. The system shall be capable of controlling and integrating multiple security functions including the configuration, management and monitoring of cardholder access, locking hardware units, events, alarms, visitors, and real-time tracking and reporting. The ACS is to be alterable at any time depending on the facility requirements and will allow for easy upgradeability or modification of network processors, controller, interface modules, card data, inputs, outputs, and remote workstations. The ACS shall include, but is not be limited to, the following:
1. Client/Server model operating central server host software modules and client workstation software applications in a multi-user and a multi-tasking environment.
 - a. The ACS to permit multiple instances of client software applications to run simultaneously on the network. The base system shall include one (1) software application licenses per site with an unlimited number of licenses available subject to connection fees.
 2. Partitioning: The system to support security partitioning enabling system administrator to segment the configuration database and group multiple entities within the security partition.
 - a. Security partitions limit what users can view in the configuration database. Administrators, who have all rights and privileges, can segment a database into multiple security partitions. A user who is given access to a specific partition will only be able to view entities (components) within the partition they have been assigned.
 3. Encryption: The system to support encrypted communication between the central server software and client software applications (server-to-server and client-to-server) using a 128-bit AES encryption algorithm (at a minimum).
 - a. Communication between the central server host software module and system controllers to be encrypted if supported by the controllers.
 - b. The ACS client software applications to be password protected with passwords stored in the central server database in an encrypted manner.
 4. Distributed Processing: The system is a fully distributed processing application allowing information, including time, date, zones, valid codes, tasks, access levels, and similar data, to be downloaded from the central host station to

controller interface devices allowing access-control decisions with or without central host station communication. If communications to a central host station are lost, the controllers will automatically buffer event transactions until communications are restored and events are automatically uploaded to the central host station.

- a. Provide for a higher level of distributed database management at defined perimeter access points such that no single point of failure will allow more than two access points to fail, or affect more than two access points at perimeter points system wide.
5. Single Data Base: The system to support a single database for access control site setup, credential and identity file creation, alarm and control setup, and system user operation and command functions.
6. System Access Management: The system to allow operators through password authentication the ability to make access granted or denied decisions, define access levels, time zones, holidays, assign cardholders, access groups, develop tasks, and generally manage access control, alarm monitoring and response activities system wide from a single login. Operator and user privileges are managed by a system administrator allowing for different levels of system access and system control. Authorization management is fully Owner definable.
7. Cardholder Management: The system to include a cardholder management system integrated within the access control system. This cardholder management functionality allows the enrollment of cardholders into the database, and import / export of employee data.
8. Access Groups and Access Levels: The system to provide adequate access groups and access level assignment capability to meet Owner requirements for the specified project. If required, software application can be expandable to support unlimited access groups and access levels.
9. Alarm Monitoring: The system is able to monitor, report, and provide information about the time and location of alarms, along with their priority.
10. Event Monitoring: The system is able to monitor, report, and archive network access control activity.
11. Transaction Logs: The system to support an unlimited number of logs and historical transactions (events and alarms) with the maximum allowed being limited by the amount of hard disk space available.
12. System Monitoring: The system to have ability to report on the integrity of all network assigned devices, circuits and communications and provide a diagnostics screen showing field level communications system wide
13. Lock/Unlock Commands: The system to allow an operator to manually lock and unlock doors overriding scheduled access control restrictions and configurations if necessary.
14. Hardware Interface: The system to integrate with and control specified electrified hardware, signaling and monitoring devices.
15. Report Generator: The system to have the ability to generate and output reports with any and all combinations of system fields and data including, but not limited to: by cardholder, by door, by site, by time, by groups of doors and by cardholder field. Any and all combinations of fields must be available for reporting. The report feature to allow exporting of generated reports over a network connection or by remote printing.
16. Multi-User/Web Based Network Capabilities: The system to support multiple operator workstations via local area network/wide area network (LAN/WAN), the Internet, or VPN. The system to be capable of supporting minimum of concurrent users/clients with software expansions to an unlimited number of workstations based on the Owners network requirements.

- B. Open Protocol: The ACS manufacturer to provide non-proprietary, open protocol hardware for the system control processors and associated device sub-controllers. Systems utilizing a single manufacturer solution that encompasses combined proprietary software and integrated electronic hardware combinations are not acceptable. In addition, integrated electronic locking hardware requiring a processor or sub-controller module upgrade, or extensive access control firmware upgrades to accommodate integrating with an alternate software package, will not be considered.
- C. Network Support: Communication network connecting the central server host software modules, client workstation software applications, and hardware controllers to be designed to support all of the following:
 - 1. LAN/Ethernet enterprise ring topology and localized star topology based on TCP/IP.
 - 2. Direct-connected RS-232 and RS-485 communication cabling.
 - 3. Dial-up modem connection using a standard dial-up telephone line.
- D. Provide local communication port at each panel for local configuration of system with laptop.
- E. Locate all main control panels in MDF and IDF rooms of each building.
- F. Provide 120v at all controller and power supply locations.
- G. Provide and transfer all required licensing to the owner.
- H. Provide local communication port at each panel for local configuration of system with laptop.
- I. Integrated Elevator Destination Dispatch Control Solutions
 - 1. The ACS shall provide means of integration with the following elevator systems destination dispatch control solution. Integration shall be by software or input/output connection (software, if available between the specified ASC and Elevator System):
 - a. Otis
 - b. Krone
 - c. Thyssen-Krupp
 - 2. The destination dispatch control solution shall provide the following functions:
 - a. Provide card reader security within the elevator(s) as required.
 - b. Provide card reader security at the Destination Dispatch kiosk(s), as required.
 - c. Allow Default Floor call registration upon card swipe.
 - d. Allow for card flags such as VIP and ADA from a card swipe
 - e. Enforce elevator access levels

2.5 ACCESS CONTROL PANEL HARDWARE

- A. Reference Attachment 'A'
- B. System Back-Up Battery: The System Installer shall provide backup batteries as required to furnish ninety (90) minutes of run time to the complete system, including but not limited to lock power and system power.

2.6 FIELD DEVICES

- A. General: Coordinate with door hardware and access control schedule as to whether each access control portal is wireless or directly connected to a control panel. Provide all Controllers, Sub-Controllers, and licensing as required to connect all card reader locations shown on plan.
- B. Card Readers: Provide card readers as shown on the floor plans, access control schedule, and access control details.
- C. Credentials: Coordinate Facility Code, External Start Number, and Internal Start number with the Owner prior to procuring credentials.

- D. Miscellaneous Devices: Provide the following devices as designated per the project floor plans, access control schedules, and access control details:
 - 1. DP/DT Door Position Sensors (Door Contacts)
 - 2. PIR Motion Request to Exit Sensor
 - 3. Lockdown Buttons
 - 4. Door Release Buttons
 - 5. Video Intercom Door Stations (Provide and Install per drawings and Division 28 Audio / Video Intercom specification)
 - 6. Video Intercom Master Stations (Provide and Install per drawings and Division 28 Audio / Video Intercom specification)

2.7 WIRING

- A. All cable associated with the ACS shall be purple in color.
- B. Ethernet cabling to access control panels shall be as specified in the Structured Cabling System (SCS) specifications and shall be provided by the SCS Installer. In the event that there is not SCS installer on the project, cabling shall be provided and installed by the ACS Installer and shall comply with the Division 27 SCS specification, minimum of Category 6A cable shall be utilized if not specified otherwise.
- C. Provide cabling and connections for all access control doors in this scope, existing and new. Conventional access control cable shall be a jacketed composite cable. The minimum conductor requirement shall be as follows:
 - 1. Standard
 - a. Lock Power: 4-conductor, 18AWG, shielded
 - b. Card Reader: 6-conductor, 22AWG, OA shielded
 - c. Door Contact: 2-conductor, 22AWG, shielded
 - d. Request to Exit/Spare: 4-conductor, 22AWG, shielded
 - 2. Extended Distance
 - a. Lock Power: 4-conductor, 16AWG, shielded
 - b. Card Reader: 6-conductor, 18AWG, OA shielded
 - c. Door Contact: 2-conductor, 18AWG, shielded
 - d. Request to Exit/Spare: 4-conductor, 18AWG, shielded
- D. Wire scheme and conductor quantity shall be as required by the manufacture's specifications. The System Installer to provide and install shielded cable as required.
- E. All 120v Power shall be furnished by the Division 26 contractor. In the event that a division 26 contractor is not contracted for the project, the system installer shall contract a licensed electrical firm to provide and install all materials required to furnish a complete and operational system.
- F. All Security Conduit as required for a complete installation of this system shall be furnished by the division 26 contractor as part of their scope of work. In the event that a division 26 contractor is not contracted for the project, the system installer shall provide and install all conduit required.
- G. Coordination with the Division 26 contractor is the responsibility of the ACS Installer to ensure all conduit is in place for a complete installation.
- H. All systems shall be connected to a dedicated circuit and on an emergency power source if available.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All wiring shall be in accordance with the National Electrical Code, Local Codes, and article 760 of NFPA Standard 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.
- B. All wire shall be UL Listed CL2 for limited energy (300V) applications and shall be installed in conduit. Limited energy MPP wire may be run open in return air ceiling

- plenums provided such wire is UL Listed for such applications and is of the low smoke producing fluorocarbon type and complies with NEC Article 760 if so, approved by the local authority having jurisdiction.
- C. No AC wiring or any other wiring shall be run in the same conduit as security alarm wiring.
 - D. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
 - E. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
 - F. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.
 - G. All vertical wiring and all main trunk/riser wiring shall be installed in a complete raceway/conduit system. All riser boxes shall be adequately sized for the number of conductors transversing the respective box as well as the number of terminations required.
 - H. Network Connection Cable: Provide a 4 pair Category 6A data cable from the Master Control Panel to the MDF network rack. Category 6A cable shall be purple in color.
 - I. All plenum wiring is to be installed parallel and perpendicular to the building structure. Install wiring tight up against structure for protection. Cable shall be bundled on a maximum of 2'-6" and secured to the structure at a maximum of 5' on center. Bundling and support shall be with plenum rated cable ties.
 - J. System Installer is required to provide all mapping and software configuration required to operate system as per manufacturer's recommendations.

3.2 CABLE PATHWAYS

- A. Cable Support:
 - 1. All wire not installed inside conduit or a designated cable tray system shall be installed in a dedicated cable support system for the entire run of each cable. Including, but not limited to service loops.
 - a. Approved Cable Support Product:
 - 1) Panduit
 - 2) Arlington
 - 3) Caddy
 - 4) Support system shall be sized appropriately for the number of wires being installed. Reference the manufacturer's specifications for the suggested maximum cables per support size.
 - 2. The approved cable support system shall be attached directly to the building steel at a serviceable height. In the event that the building steel is not 5' of the finished ceiling, the system installer shall provide a dedicated threaded rod extending within 5' of the finished ceiling and mount the cable support hook to the treaded rod.
 - 3. The cable support shall be installed at a maximum of 5' on center.
 - 4. All cable installed shall be attached to the cable support system with plenum rated Velcro and a plenum rated Velcro tie shall be installed between each cable support to keep wires neatly bundled throughout the entire run. Tie wraps will only be allowed to be used inside the control panels as required to manage the wires within each type of panel.
 - 5. Absolutely no cable, not installed in conduit, will be allowed to be attached directly to the building's steel or supported in any other method than that stated above.
 - 6. It is the responsibility of the system installer to coordinate with all other trades

on the project to ensure that the pathway of this system does not interfere with the installation of the other trades and to prevent the installed product of other trades from putting strain on the installed wiring.

- B. Conduit / Raceway:
 - 1. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
 - 2. Conduit and raceway system shall be installed as specified under the general electrical section of the specifications, and per NEC.
 - 3. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
 - 4. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.
 - 5. All conduit ends shall have a protective bushing to prevent cable damage. Bushings must be installed prior to installing cable. Cutting bushing to install around installed cables will not be accepted.

3.3 TESTING

- A. Submit a written test report from an authorized representative of the equipment manufacturer that the system has been 100% tested and approved. Final test shall be witnessed by Owner and the project's Technology Consultant and performed by the equipment supplier. Final test report must be received and acknowledged by the Owner prior to substantial completion.
- B. Provide instruction as to proper use and operation of system, for the Owner's designated personnel.

3.4 WARRANTY

- A. Entire system shall be warranted against defects in materials and workmanship for a period of one (1) year from the date of substantial completion.

3.5 SOFTWARE

- A. Provide two electronic copies of the final programming and program software to the Owner's Security Supervisor after final approval.

ATTACHMENT 'A'
PROJECT SPECIFIC SCOPE OF WORK AND EQUIPMENT LIST

PART 1 – PROJECT SCOPE

1.1 DESCRIPTION OF WORK

- A. This project is an expansion of an existing access control system and consists of the provision and installation of a complete and functional Access Control System (ACS) as required to furnish controlled access and access detection to all controlled portals identified on the project drawings. This project is an elementary school renovation for the Cypress-Fairbanks Independent School District.
- C. All existing to remain card readers shall be reconnected to new access control system panels. Existing edge controllers shall be removed and returned to owner.
- B. It should not be assumed that any portions of a complete and functional system are to be furnished and/or provided by anyone, other than the ACS installer, unless specifically stated otherwise.

PART 2 – EQUIPMENT LIST

2.1 The ACS installer shall perform no portion of the work requiring submittal and review of record drawings, shop drawings, product data, or samples until the respective documentation has been approved by project's Security Consultant.

2.2 PERIMETER AND INTERIOR DOOR CONTROL PANELS

- A. Door Control Panels are to be installed as needed in MDF/IDF rooms throughout the campus, to provide communications and power for access control devices in the area of influence of each IDF. Reference floor plans for exact locations. Locations shown outside of MDF/IDFs have been coordinated with owner.
- B. All hardware is to be mounted in an Altronix Trove 2 enclosure with RSB2 switch plate. Panel must have a provided emergency power circuit to the RB2 switch panel to enable ease of power shut off for the power supply by one switch and main panel transformer on the secondary switch.
- C. One (1) Intelligent Door Controller and door Sub Controllers shall be populated in the Altronix enclosure sufficient to provide access controls for all doors to be controlled from the IDF, for a minimum of eight (8) doors. The Intelligent Controller shall be IP-based. SubControllers should connect to the Intelligent Controller via network or RS-485 Data Bus.
- D. An Altronix eFlow 10XNB power supply is required to be provided and installed along with a PDS8CB or PD16W Power Distribution Module and ACM8CB Access Power Controller. A (1) VR6 regulator in the enclosure to provide correct power distribution.
- E. Two Category 6A network drops are required within the panel for local configuration of system with laptop and primary panel communication. Each drop should be properly labeled per network cabling guidelines.
- F. Panel IP network configuration information shall be provided by the owner.
- G. Final software configuration / programming of system integration will require owner / system installer consultation.
- H. System Back-Up Battery: The System Installer shall provide backup batteries as required to furnish ninety (90) minutes of run time to the complete system, including but not limited to lock power and system power.

2.3 PERIMETER FENCE GATES

- A. Access Controlled gates shall be connected to an IP-based Door controller which may be installed near the building perimeter wall, closest to the gate, to provide additional cabling distance.
- B. Door Controller will require network data drop provided by Division 27 contractor interior

- C. of the building. To provide communications and power for the access-controlled devices. Location will require Access control power supply unit at controller location on dedicated emergency power circuit. All 120v Power shall be furnished by the Division 26 contractor. In the event a Division 26 contractor is not contracted for the project, the system installer shall contract a licensed electrical firm to provide and install all materials required to furnish a complete and operational system.
- D. Proper surge arrestment devices must be employed if installation requires underground cabling to be utilized.
- E. Reader module on fence gate shall be Schlage # PR10.
- F. Lock assembly shall be HES 9600 Series electric strike with suitable outdoor rating and door position switch monitoring capability. Door position switch to be tied into intrusion system for monitoring purposes.

2.4 VEHICLE ACCESS GATES

- A. Access Controlled gates shall be connected to an IP-based 2-Door controller which may be installed near the building perimeter wall, closest to the gate, to provide additional cabling distance.
- B. 2N Video Intercom (w/Wiegand and Proximity reader module) to be installed on pedestal via Pedestal Pro part # HUO-PRO-0010-CRS-B housing for access control entry through controlled vehicle gate. Exterior gate housing will require use of 2N part # 01285-001 to complete installation correctly.
- C. All gates must have a Tagmaster XT-1 RFID reader installed as the secondary for utilization of district vehicle tag system.
- D. Tagmaster installation and testing must be done with Owner on site to confirm configuration.
- E. Consultation is required with the owner to determine is additional Vehicle Tags will be required at the time of installation and the amounts needed.

2.5 FIELD DEVICES

- A. Card Access Equipment
 - 1. All Card Readers locations to be installed on walls or pedestrian gates shall be PR10 card readers as manufactured Schlage.
 - 2. All Card Readers locations to be installed on doors shall be SN200 series readers as manufactured by Sargent.
 - 3. Access Control contractor shall provide ALL electronic components required for a complete and functioning access control system, to include card reader, door contact, lock power supply, electrified locking device with integrated request to exit, power transfer hinge and wiring harnesses. The door hardware contractor shall be responsible for non-electrified, mechanical door hardware.
 - 4. Access Control contractor shall provide all cabling required for connection to any device incorporated and not incorporated in door hardware.
 - 5. Contractor shall provide 300 HID proximity cards 1386 Series for this campus. CFISD has a Corporate 1000 account set up with HID. The contractor shall purchase cards through HID using this account to ensure card numbers and facility numbers are followed.
 - 6. Provide Ethernet Network Interface to connect school to district-wide access control system. Connect to local area network at each facility.
 - 7. Contractor shall provide all cabling and accessories required to provide complete access control solution and proper integration with building intrusion alarm system for door contact shunting.
 - 8. All called for release buttons shall be united security products #HUB2SA momentary under counter release switch.
 - 9. Provide all door controllers as required to connect all perimeter card reader

locations shown on plan plus one additional of each type for attic stock.

2.6 WIRING

- A. Access Control Contractor shall provide and install Access Control system cabling.
 - 1. Color code of all security intrusion detection system an access control wiring shall be purple in color.
Approved products: Lake Composite Access Control Cable: S800081709-07
 - 2. Ethernet cabling to access control panels shall be as specified in the Structured Cabling System (SCS) specifications and shall be provided by the SCS Installer. In the event there is not SCS installer on the project, cabling shall be provided and installed by the ACS Installer and shall comply with the Division 27 SCS specification. Minimum of Category 6 cable shall be utilized if not specified otherwise.
 - 3. All systems shall be connected to a dedicated circuit and on an emergency power source.
 - 4. All 120v Power shall be furnished by the Division 26 contractor. In the event a Division 26 contractor is not contracted for the project, the system installer shall contract a licensed electrical firm to provide and install all materials required to furnish a complete and operational system.
 - 5. All Security Conduit as required for a complete installation of this system shall be furnished by the Division 26 contractor as part of their scope of work. In the event Division 26 contractor is not contracted for the project, the system installer shall provide and install all conduit required.
 - 6. Coordination with the Division 26 contractor is the responsibility of the ASC installer to ensure all conduit is in place for a complete installation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All wiring shall be in accordance with the national Electrical Code, Local Codes and article 760 of NFPA Standard 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.
- B. All wire shall be UL Listed CL2 for limited energy (300V) applications and shall be installed in conduit. Limited energy MPP wire may be run open in return air ceiling plenums provides such wire is UL Listed for such applications and is of the low smoke producing fluorocarbon type and complies with NEC Article 760 if so approved by the local authority having jurisdiction.
- C. No AC wiring or any other wiring shall be run in the same conduit as security alarm wiring.
- D. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
- E. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
- F. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.
- G. All vertical wiring and all main trunk/riser wiring shall be installed in a complete raceway/conduit system. All riser boxes shall be adequately sized for the number of conductors traversing the respective box as well as the number of terminations required.
- H. Network Connection Cable: Provide a Category 6 data cable from the Master Control Panel/Node to the MDF network rack. Category 6 cable shall be purple in color.
- I. All plenum wiring is to be installed parallel and perpendicular to the building structure. Install wiring tight up against structure for protection. Cable shall be bundled on a maximum of 2'-6" and secured to the structure at a maximum of 5' on center. Bundling and support shall be with plenum rated Velcro ties and J-Hooks. (Ref. 28-13-00 3.3A)
- J. Contractor is required to provide all mapping and software configuration required to

operate system as per manufacturer's recommendations.

3.2 CABLE PATHWAYS

A. Cable Support:

1. All wire not installed inside conduit or a designated cable tray system shall be installed in a dedicated cable support system for the entire run of each cable. Including but not limited to service loops.
 - a. Approved Cable Support Product:
PANDUIT® Corporate J-MOD™ modular support system (sized appropriately for the number of wires being installed. Reference the manufacturer's specifications for the suggested maximum cables per support size).
2. The approved cable support system shall be attached directly to the building steel at a serviceable height. In the event that the building steel is not 5' of the finished ceiling, the contractor shall provide a dedicated threaded rod extending within 5' of the finished ceiling and mount the J-MOD™ support hook to the threaded rod.
3. J-MOD™ cable support shall be installed at a maximum of 5' on center.
4. All cable installed shall be attached to the J-MOD™ support system with plenum rated Velcro and a plenum rated Velcro tie shall be installed between each J-MOD™ cable support to keep wires neatly bundled throughout the entire run. Tiewraps will only be allowed to be used inside the control panels as required to manage the wires within each type of panel.
5. ABSOLUTELY NO CABLE, NOT INSTALLED IN CONDUIT, WILL BE ALLOWED TO BE ATTACHED DIRECTLY TO THE BUILDING'S STEEL OR SUPPORTED IN ANY OTHER METHOD THAN THAT STATED ABOVE.
6. IT IS THE RESPONSIBILITY OF THE INSTALLING CONTRACTOR TO COORDINATE WITH ALL OTHER TRADES ON THE PROJECT TO ENSURE THAT THE PATHWAY OF THIS SYSTEM DOES NOT INTERFERE WITH THE INSTALLATION OF THE OTHER TRADES AND TO PREVENT THE INSTALLED PRODUCT OF OTHER TRADES FROM PUTTING STRAIN ON THE INSTALLED WIRING.

B. Conduit / Raceway

1. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
2. Conduit and raceway system shall be installed as specified under the general electrical section of the specifications, and per the NEC.
3. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
4. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.
5. All conduit ends shall have a protective bushing to prevent cable damage. BUSHINGS MUST BE INSTALLED PRIOR TO INSTALLING CABLE. CUTTING BUSHING TO INSTALL AROUND INSTALLED CABLES WILL NOT BE ACCEPTED.

3.3 TESTING

- A. Submit a written test report from an authorized representative of the equipment manufacturer that the system has been 100% tested and approved. Final test shall be witnessed by Owner, Engineer, Electrical Contractor, Door Hardware Installer, and

performed by the equipment supplier. Final test report must be received and acknowledged by the Owner prior to substantial completion.

3.4 WARRANTY

- A. Entire system shall be warranted against defects in materials and workmanship for a period of one (1) year from the date of substantial completion.
- B. Installed main system devices must be awarded the same warranty provided to the installer by the Manufacturer of the product.

3.5 SOFTWARE

- A. Provide two electronic copies of the final programming and program software to the Owner's Security Supervisor after final approval.

END OF SECTION

SECTION 28 1000.05
AUDIO / VIDEO INTERCOM (IP)

PART 1 - GENERAL

1.1 RELATED WORK

- A. The following, in their entirety and as applicable, shall apply to this section. Including any associated drawings.
 - 1. Conditions of the Contract
 - 2. Division 1
 - 3. Division 26
 - 4. Division 27
 - 5. Division 28

1.2 SYSTEM DESCRIPTION

- A. General Requirements:
 - 1. The specified unit shall be of manufacturer's official product line, designed for commercial and/or industrial 24/7/365 use.
 - 2. The specified unit shall be based upon standard components and proven technology using open and published protocols.
- B. Sustainability
 - 1. The specified unit shall be manufactured in accordance with ISO 14001.
 - 2. The specified unit shall be compliant with the EU directives 2011/65/EU (RoHS) and 2012/19/EU (WEEE).
 - 3. The specified unit shall be compliant with the EU regulation 1907/2006 (REACH).

1.3 CERTIFICATIONS AND STANDARDS

- A. General abbreviations and acronyms
 - 1. AES: Advanced Encryption Standard
 - 2. API: Application Programming Interface
 - 3. Bit Rate: The number of bits/time unit sent over a network
 - 4. DHCP: Dynamic Host Configuration Protocol
 - 5. DNS: Domain Name System
 - 6. FPS: Frames per Second
 - 7. FTP: File Transfer Protocol
 - 8. H.264 (Video Compression Format)
 - 9. IEEE 802.1x: Authentication framework for network devices
 - 10. IP: Internet Protocol
 - 11. IR light: Infrared light
 - 12. ISO: International Standards Organization
 - 13. JPEG: Joint Photographic Experts Group (image format)
 - 14. LAN: Local Area Network
 - 15. LED: Light Emitting Diode
 - 16. MPEG: Moving Picture Experts Group
 - 17. Multicast: Communication between a single sender and multiple receivers on a network
 - 18. NTP: Network Time Protocol
 - 19. ONVIF: Global standard for the interface of IP-based physical security products
 - 20. PACS: Physical Access Control System
 - 21. PoE: Power over Ethernet (IEEE 802.3af/at) standard for providing power over network cable
 - 22. Progressive scan: An image scanning technology which scans the entire picture
 - 23. QoS: Quality of Service
 - 24. RPC: Remote Procedure Call

25. SIP: Session Initiation Protocol
 26. SMTP: Simple Mail Transfer Protocol
 27. SNMP: Simple Network Management Protocol
 28. SSL: Secure Sockets Layer
 29. TCP: Transmission Control Protocol
 30. TLS: Transport Layer Security
 31. Unicast: Communication between a single sender and single receiver on a network
 32. UPS: Uninterruptible Power Supply
 33. VBR: Variable Bit Rate
 34. VMS: Video Management System
 35. WDR: Wide dynamic range
- B. The specified unit shall carry the following EMC approvals:
1. EN55032: 2012
 2. EN55024: 2010
 3. 2014/35/EU
 4. 2014/30/EU
 5. 2012/19/EU
 6. 2011/65/EU
 7. EN 55032 Class A
 8. EN 55032 Class B
 9. EN 55024
 10. FCC Part 15 - Subpart B Class A
 11. FCC Part 15 - Subpart B Class B
 12. FCC Part 15 - Subpart B Class A + B
 13. ICES-003 Class A
 14. ICES-003 Class B
- C. The specified unit shall meet the following product safety standards:
1. IEC/EN/UL 60950-1
- D. The specified unit shall meet the following standards
1. Audio:
 - a. G.711
 - b. G.729
 - c. G.722 (wideband)
 - d. L16 / 16kHz (wideband)
 2. Video:
 - a. H.263+
 - b. H.263
 - c. H.264 (MPEG-4 AVC)
 - d. MPEG-4 Part 2
 - e. MJPEG
 3. Networking:
 - a. IEEE 802.3af/802.3at (Power over Ethernet) [applies to products with PoE]
 - b. IEEE 802.1X (Authentication)
 - c. IPv4 (RFC 791)
 - d. QoS
 4. Mechanical Environment:
 - a. IEC/EN 60529 IP54
 - b. IEC/EN 62262 IK08

1.4 QUALITY ASSURANCE

- A. Contractor Qualifications:
-

1. The system installer shall be the authorized representative of the manufacturer to sell, install, and service the proposed manufacturer's equipment. The system installer shall have represented the security alarm manufacturer's product for a minimum of five (5) years' with experience installing and servicing systems of similar scope and complexity and evidence that is completed at least three (3) projects of similar design and is currently engaged in the installation and maintenance of systems herein described.
 2. The system installer shall be licensed as required, by the State in which the project is located in, as a security services contractor to design, sell, install, and service security alarm systems.
 3. The system installer shall provide 24-hour, 365 days per year emergency service with factory trained service technicians.
 4. The installing firm shall have personnel on their staff that has been actively engaged in the business of designing, selling, installing, and servicing security systems for at least ten (10) years.
 5. The proposing contractor for this system and the installing contractor of this system shall be of the same organization. Absolutely no subcontracting of any portion of this system by the proposing contractor will be allowed.
 6. The proposing/installing contractor of this system must be an authorized dealer / integrator for the project's specified Access Control, Video Surveillance and the Intrusion Detection systems as well as the system specified in this section.
 7. Contractor must be a current integrator of solution in the closest major metropolitan area marketplace, have a permanent office located within 75-miles of the project, and be able to include information on current support staff to be able to service this client.
 8. All installation, configuration, setup, program and related work shall be performed by electronic technicians thoroughly trained by the manufacturer in the installation and service of the equipment provided.
 9. The system installer shall submit credentials of completed manufacturer certification, verified by a third-party organization, as proof of the knowledge.
 10. The Contractor shall provide four (4) current references from clients with systems of similar scope and complexity that became operational in the past three (3) years. At least three (3) of the references shall be utilizing the same system components, in a similar configuration as the proposed system
 11. Contractor must be in good standing with the Owner and have no outstanding performance or warranty items at the time of bid. Any outstanding items or issues is grounds to disqualify the Contractor for performing any work on the project.
- B. System Qualifications:
1. The specified unit shall be manufactured in accordance with ISO9001.

1.5 SUBMITTALS AND CLOSE-OUT

- A. Product Data:
1. Within fourteen (14) days of Notice to Proceed, the system installer shall furnish the following in a single consolidated submittal:
 - a. Permits: The Contractor shall obtain all required permits and provide copies to the Owner / Architect / Engineer.
 - b. Product Literature: Complete manufacturer's product literature for all system equipment, power supplies, cable, termination components, cable supports, cable labels, field devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner/Designer) and the manufacturer's supporting documentation, demonstrating

- compatibility with other related products shall be included. The submittal shall have some type of distinguishing marker or pointer to indicated what specific product is to be submitted.
- c. Construction Schedule: A time-scaled Construction Schedule indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
 - d. Specification Compliance: A letter shall be provided stating, by section and subsection, that the system installer complies with the ENTIRE specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been accepted by the project's technology consultant.
 - e. Certifications: The contractor shall submit all of the following certifications and the certifications must contain dates which are valid from the date of proposal and not expire any sooner than 12 months after substantial completion of the project.
 - 1) Manufacturer's Authorized Dealer/Installer Certification: This certification must be held by the proposing/installing contractor and state that the proposing/installing contractor is and authorized dealer/installer of the system specified within the project specifications. The certification must have been obtained by the office that is within a 75-mile radius of the project's location.
 - 2) Installer Certification: This certification must be held by at least 25% of the, on-site, staff and be made available at the site if requested by the owner, architect, and/or project's technology consultant.
 - 3) Licenses: This includes all licenses required by the state in which the work is being performed, the federal government, local authorities having jurisdiction, and any organization in that governs the specific system
- B. Shop Drawings:
- 1. Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
 - a. Proposed circuit routing and circuit grouping plan prepared by a system registered designer. The designer's certification must be current. Identifiable, separate routing shall be shown for both the station cabling and any backbone trunk cabling.
 - b. In addition to the cable routing, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:
 - 1) Location of all control equipment and remote power sources
 - 2) Locations of all field devices and outlets
 - 3) Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)
 - 4) Location of sleeved wall and/or floor pass-thru
 - 5) Size of sleeve at each location installed
 - 6) Quantity of cable passing through each sleeve
 - 7) Conduit routing, size, quantity, and stub-up locations for any floor mounted outlets or outlets installed in casework.
 - c. Drawing Compliance: A letter shall be provided stating that the system installer complies with the entire project drawing, including all general,

keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the project's technology consultant.

- C. Close-out Procedures: For review and acceptance, furnish an electronic copy of the following documents to the Architect / Engineer. Upon acceptance of the submitted close-out documents, provide four (4) copies on an electronic storage media (CD or USD Flash Drive) Labeled with the project name, date of submission, and the name of the submitting firm. Final copies shall be delivered directly to the project's Technology Consultant. The closeout submittals shall include the following and be packaged in a storable container with the physical storage media and any physical items listed:
1. Inspection and Test Reports: During the course of the Project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed, conform to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
 2. Provide complete test reports for all cabling and devices that comprise system as outlined in this document.
 3. Include the Name, address and telephone of the authorized factory representative with a 24-hour emergency service number.
 4. The manual shall also include Manufacturer's data sheets and installation manuals/instructions for all equipment installed and a list of recommended spare parts.
 5. Generic or typical owner's instruction and operation manual shall not be acceptable to fulfil this requirement.
 6. An up-to-date record ("as-built") set of approved shop drawing prints that have been revised to show each and every change made to the system from the original approved shop drawings.
 7. As-built Drawings shall include cable pathways; device locations with correct labeling, control equipment locations, remote power supply locations, cross connect locations, and lightning protection locations. The as-built drawings shall be prepared using AutoCAD 2014 or later.
 8. All drawings must reflect point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system.
 9. A copy of the manufacturer's warranty on the installed system.
 10. Any keys to cabinets and/or equipment and special maintenance tools required to repair, maintain, or service the system.
 11. Operating and Maintenance Instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction, and shall be provided to the Owner, for their use, in a three-ring binder labelled with the project name and description. (4 copies)
 12. Upon completion of the work and at a time designated by the Architect or owner, provide formal training sessions for the Owner's operating personnel to include location, operation, and maintenance of all included systems and equipment. Provide a video copy of the training session as well as all sign in and training sign off sheets
 13. One (1) 30" x 42" laminated floor plan sheets illustrating device locations, system wiring configuration, and cable designation. Contractor shall provide one

complete floor plan sheet at each panel location.

1.6 WARRANTY

- A. All security system components and labor furnished by the contractor including wiring, software, hardware and custom parts shall be fully warranted for parts, materials, labor and travel expenses for a minimum of three (3) years start from the date of substantial completion.
- B. The manufacturer shall provide warranty and optional extended warranty for the unit for a total period of maximum five years. If enacted as part of the contract, the contractor will repair or replace parts and/or labor per the warranty for the length of this warranty at no cost to the client.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Intercoms shall be IP-based and comply with established network and video standards.
- B. Intercoms shall be powered by the switch utilizing the network cable.
- C. Intercoms shall be fully supported by an open and published API (Application Programmers Interface), which shall provide necessary information for integration of functionality into third party applications.

2.2 INTERCOM SCHEDULE

- A. Intercom types listed below describing various resolutions, form-factor and features shall be supplied by a single intercom manufacturer.
- B. The intercom manufacture and model numbers will be as follows:
 - 1. Modular IP intercom shall be 2N IP Verso with camera. Part # 02907-001
 - 2. IP intercom base station shall be 2N Indoor View. Part # 02088-001
 - a. 2N Base station stand required. Part # 02039-001
 - 3. 2N Combo Reader Module. Part # 02778-001
 - 4. 2N Secure Door Set Tamper. Part # 01975-001
 - 5. 2N Weigand Module. Part # 01259-001
 - 6. 2N Surface frame plate. Part # 01289-001
 - 7. 2N Surface back plate. Part # 01294-001

2.3 INTERCOM

- A. Modular IP intercom
 - 1. The intercom shall meet or exceed the following design specifications:
 - a. Intercom shall include a built-in web server.
 - b. Intercom shall be able to perform defined local access control functionality without being connected to the network.
 - c. Intercom shall be of modular design, include a replaceable front-end frame, providing 1 or 2 additional slots for functional modules, and should support multiple frames stacked side by side. The intercom shall support at least 29 functional modules when fully expanded.
 - d. Intercoms' main unit shall be available with and without camera, and shall support the following functional modules:
 - 1) ID card reader
 - 2) Fingerprint reader
 - 3) Keypad
 - 4) Button module
 - 5) Touch screen
 - 6) Bluetooth
 - 7) Wiegand interface
 - e. The intercom shall be equipped with an IR-sensitive progressive scan

- megapixel sensor and be able to provide images also under dark conditions.
- f. The intercom shall be equipped with built-in power adaptive IR-illumination/LED.
 - g. The camera shall provide an automatic IR-cut filter, providing day/night functionality.
2. The intercom shall meet or exceed the following performance specifications:
- a. Video
 - 1) The intercom shall provide video streams in 640x480 at up to 30 frames per second using H.264, H.263, H.263+ or up to 15 frames per second using MJPEG.
 - 2) The intercom camera shall provide images in resolutions up to 1280x960.
 - 3) The intercom shall support the following video encoding algorithms:
 - a) H.263+
 - b) H.263
 - c) H.264
 - d) MPEG-4 Part 2
 - e) MJPEG
 - 4) The intercom shall provide independently configured simultaneous H.264 and MJPEG streams.
 - 5) The intercom shall in H.263, H.263, H.264 support Constant Bit Rate (CBR) to protect the network from unexpected bit rate peaks.
 - 6) The intercom shall provide configurable compression levels.
 - 7) Support standard baseline profile H.264 with motion estimation.
 - 8) Support motion estimation in H.264/MPEG-4 Part 10/AVC.
 - 9) The intercom shall allow for video to be transported over:
 - a) HTTP (Unicast)
 - b) HTTPS (Unicast)
 - c) RTP (Unicast & Multicast)
 - d) RTP over RTSP (Unicast)
 - e) RTP over RTSP over HTTP (Unicast)
 - 10) The intercom shall support Quality of Service (QoS) to be able to prioritize traffic.
 - b. Image
 - 1) The camera shall incorporate automatic white balance.
 - 2) The camera shall support manually defined values for:
 - a) Color level
 - b) Brightness
 - c. Audio
 - 1) The intercom shall support two-way full duplex audio:
 - a) Input sources
 - (1) Internal microphone
 - b) Output sources
 - (1) Built-in speaker, 2W
 - (2) Line out
 - 2) The intercom shall support separately adjustable volume levels for:
 - a) Call
 - b) Key
 - c) Ring tones

- d) Preloaded audio clips
- e) Warning tones
- f) Paging
- 3) The intercom shall support adaptive gain control.
- 4) Encoding
 - a) The intercom shall support:
 - (1) G.711
 - (2) G.722 (wideband)
 - (3) G.729
 - (4) L16 / 16kHz (wideband)
- 5) The intercom shall provide a sound pressure level of at least 78dB at 1kHz at 1m.
- 6) The intercom shall be equipped with active echo cancellation.
- 7) The intercom shall allow for audio to be transported over:
 - a) RTP (Unicast & Multicast)
 - b) RTP over RTSP (Unicast)
 - c) RTP over RTSP over HTTP (Unicast)
- 8) The intercom shall support Quality of Service (QoS) to be able to prioritize traffic.
- d. Call functionality
 - 1) The intercom shall support SIP for integration with VoIP, peer-to-peer or integrated into SIP/PBX.
 - 2. The intercom shall support the use of SIP Proxy, which can be the same as the SIP registrar for outgoing calls.
 - 3) The intercom shall support dialing up to twelve separate numbers in sequence or as ring group.
- e. Access control functionality
 - 1) The intercoms' reader outputs shall be wired through the Weigand module to the existing access control system.
- f. User Interface
 - 1) Web server
 - a) The intercom shall contain a built-in web server making functionality and configuration available to multiple clients in a standard operating system and browser environment using HTTP, without the need for additional software.
 - 2) IP addresses
 - a) The intercom shall be set with dynamically assigned IP addresses provided by a Dynamic Host Control Protocol (DHCP) server.
 - b) The intercom shall allow for automatic detection of the intercom based on WS Discovery when using a computer with an operating system supporting this feature.
 - c) The intercom shall provide support for IPv4.
- g. Event functionality
 - 1) The intercom shall be equipped with an integrated event functionality, which can be triggered by:
 - a) Tamper / case open
 - b) SIP Call state incl. incoming call
 - c) Change of SIP registration status
 - d) Video Motion Detection
 - e) Noise Detection

- f) SIP DTMF sequences
- g) External input
- h) Access control events such as code, card, fingerprint entered
- i. Predefined time
- 2) Response to triggers shall include:
 - a) Send notification, using HTTP or email
 - b) Activate sound alarm
 - c) Make or end call
 - d) Send notification, using HTTP, HTTPS, Wiegand or email
 - e) Send images, using FTP or email
 - f) Activating external output
 - g) Play audio clip
- h. Protocol
 - 1) The intercom shall incorporate support for at least HTTP, HTTPS, SIP 2.0, TFTP, RTSP, RTP, SMTP, DHCP opt 66, NTP, Syslog.
 - 2) The SMTP implementation shall include support for SMTP authentication.
 - 3) The camera shall incorporate support for at least IPv4, HTTP, HTTPS, SIP, SSL/TLS, QoS Layer 3 DiffServ, TCP, ICMP, SNMPv2c, RTSP, RTP, UDP, IGMP, RTCP, SMTP, FTP, DHCP, ARP, DNS, NTP,
- i. Security
 - 1) The intercom shall support the use of HTTPS and SSL/TLS, providing the ability to upload signed certificates to encrypt and secure authentication and communication of both administration data and video streams.
 - 2) The intercom shall block its login page for 30 seconds after three faulty passwords have been submitted.
 - 3) The intercom shall force user to change admin password upon first installation.
 - 4) The intercom shall provide centralized certificate management, with the ability to upload CA certificates. The certificates shall be signed by an organization providing digital trust services.
 - 5) The intercom shall support IEEE 802.1X authentication.
 - 6) Selected services, such as RTSP or web config shall be configurable to only allow access from local devices.
 - 7) The intercom shall restrict access to the built-in web server by username and password.
 - 8) The intercom shall be equipped with tamper detection.
- j. API support:
 - 1) The intercom shall be fully supported by an open and published API (Application Programmers Interface), which shall provide necessary information for integration of functionality into third party applications.
 - 2) The intercom shall conform to ONVIF profile S as defined by the ONVIF Organization.
 - a) For ONVIF profile specifications, see www.onvif.org/
 - 3) The intercom shall be interoperable/certified with major PBX and gateway manufacturers, including:
 - a) Cisco

- b) Avaya
- c) Broadsoft
- k. Installation and maintenance
 - 1) The intercom shall support secure configuration using HTTPS.
 - 2) The intercom shall support the use of SNMP-based management tools according to SNMP v2c.
 - 3) The intercom shall allow updates of the software (firmware) over the network, using TFTP, HTTP or web interface.
 - 4) The intercom shall be time synchronized to the district NTP (Network Time Protocol) server.
 - 5) The intercom shall support back-up and restore of configuration.
 - 6) The intercom shall store all customer-specific settings in a non-volatile memory that shall not be lost during power cuts or soft reset.
- l. Access log
 - 1) The intercom shall be able to log events such as codes, phone calls, RFID cards etc., and provide them using HTTP interface for monitoring.
 - 2) The administrator shall be able to set whether the particular messages are sent by the intercom immediately after any event occurs, or if the client registers for event logging and then asks for full report since last registration, all events at once.
 - 3) The client shall be able to select which messages are reported from event log.
- m. Intercom diagnostics
 - 1) The intercom shall be equipped with LEDs, capable of providing visible status information. LEDs shall indicate the intercom's operational status and provide information about power, the network status and the intercom status.
 - 2) The intercom shall be monitored by a Watchdog functionality, which shall automatically re-initiate processes or restart the unit if a malfunction is detected.
- n. Hardware interfaces
 - 1) Network interface
 - a) The intercom shall be equipped with one 10BASE-T/100BASE-TX Fast Ethernet-port, using a standard RJ45 connector and shall support auto negotiation of network speed (100 MBit/s and 10 MBit/s) and transfer mode (full and half duplex).
 - 2) Doors
 - a) The intercom shall be equipped with programmable input supporting both short circuit activation or up to +30VDC for door monitor or Request to Exit (REX).
 - b) The intercom shall be equipped with two independent outputs for door control. One active providing at least 8VDC / 400mA and one NO/NC relay supporting up to 30V AC/DC 1A.
 - 3) Audio
 - a) The intercom shall be equipped with line output.
 - 4) Power
 - a) The intercom shall be equipped with a removable terminal block providing connectivity for external power.
 - 5) Multifunctional connector

- a) The camera shall, by using a “multi wire ribbon cable”, provide connectivity between main unit and modules.
- o. Enclosure
 - 1) The intercom shall:
 - a) Be manufactured with IP54 rated housing, and be IK08 (IK07 when using Touchscreen module).
 - b) Be fitted with a tamper switch.
 - c) Be of modular design, supporting main unit and up to 29 additional modules.
 - d) Be available in black and brushed nickel versions.
- p. Power
 - 1) Power over Ethernet IEEE 802.3af/802.3at Type 1 Class 0
 - 2) 12 V DC
 - a) Max: 2A
- q. Environmental
 - 1) The intercom shall:
 - a) Operate in a temperature range of -40 °C to +60 °C (-40 °F to 140 °F)
 - b) Operate in a humidity range of 10–95% RH (non-condensing).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The Contractor shall carefully follow instructions in documentation provided by the manufacturer to ensure all steps have been taken to provide a reliable, easy-to-operate complete system.
- B. All equipment shall be configured in accordance with instructions provided by the manufacturer and systems administrator prior to district inspection.
- C. All firmware found in products shall be the latest and most up-to-date provided by the manufacturer.
- D. The contractor shall provide a 2N Indoor Touch 2.0 master station at the primary operator’s desk with its appropriate stand.
- E. Contractor is responsible for working with other trades to ensure proper installation of all devices per recommended codes.
- F. All equipment requiring users to log on using a password shall be configured with district specific password. No system/product default passwords shall be allowed.

END OF SECTION

SECTION 28 2000
VIDEO SURVEILLANCE SYSTEM (VSS)

PART 1-GENERAL

1.1 RELATED WORK

- A. The following, in their entirety and as applicable, shall apply to this section. Including any associated drawings.
1. Conditions of the Contract
 2. Division 1
 3. Division 26
 4. Division 27
 5. Division 28

1.2 DESCRIPTION OF WORK

- A. Provide a complete and tested IP based digital video surveillance system (VSS) including cameras, cabling, digital image storage, integration and accessibility with Owner's Local/Wide Area Network (LAN/WAN), Internet accessibility thru remote view application software and simultaneous user access capability. Provide fully terminated unshielded twisted pair (UTP) cable, UTP terminations, racks, raceways, conduit, and other incidental and miscellaneous premises wiring system hardware as required for a complete and useable system. The installation shall comply with applicable codes and standards in effect at the job site and as indicated in the Specifications and Drawings.
- B. The system shall be Non-Proprietary in nature and be available through multiple distribution channels in the nearest metropolitan marketplace. Systems that are manufactured and installed by a factory office and are not available through multiple distribution channels will not be accepted.
- C. Provide all electronic hardware and coordinate with the building's LAN/WAN. The contractor shall coordinate with other system vendors, where appropriate, to facilitate equipment installation, scheduling, protection of equipment and access to the project site in order to provide the Owner a substantially complete project in a timely manner.
- D. Acceptable manufacturers of NVR equipment shall be Seneca Data only. Contractor must be a current Exacq Enterprise Certified integrator of the solution in the Houston marketplace and be able to include information on current support staff to be able to service this client. Seneca NVR part numbers and configuration are listed in the specification to define equipment capabilities and requirements for this project.
- E. Contractor must be a current integrator of solution in the Houston marketplace and be able to include information on current support staff to be able to service this client as needed 24x7 for emergency support.
- F. Contractor shall provide a complete turnkey solution to the owner and be responsible for the complete installation of a security camera system.
- G. The contractor must be in good standing with the district and have no outstanding performance or warranty items at the time of bid. Any outstanding items or issues is grounds to disqualify the contractors bid.
- H. This project is the expansion of the existing video surveillance system. Existing video surveillance head end is to remain.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications:
1. The Video Surveillance System Installer shall be Exacq Enterprise certified and shall meet all applicable regulations. The Contractor shall

2. be a firm normally employed in the security and surveillance industry.
2. The contractor shall be certified by the manufacturing company in all aspects of design, installation and testing of the products described herein. Each contractor shall furnish with their submittal a letter from the manufacture indicating they are a dealer in good standing.
3. The contractor must be certified by the manufacturer of the products, adhere to the engineering, installation and testing procedures and utilize the authorized manufacturer components and distribution channels.
4. The contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The contractor shall own and maintain tools and equipment necessary for successful installation and testing of video surveillance distribution systems and have personnel who are adequately trained in the use of such tools and equipment.
5. A resume of qualifications shall be submitted with the Contractor's proposal indicating the following:
 - a. A list of five recently completed projects using the product proposed of similar type and size with contact names and telephone numbers for each.
 - b. A list of test equipment proposed for use in verifying the installed integrity of metallic cable systems on this project.
 - c. A technical resume of experience for the contractor's Project Manager and on-site installation supervisor who shall be assigned to this project.
 - d. A list of technical product training attended by the contractor's personnel that shall install the video surveillance system shall be submitted.
 - e. Any subcontractor who shall assist the video surveillance contractor in performance of this work shall have the same training and certification as the video surveillance contractor.
- B. The Owner's representative reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

1.4 REGULATORY REQUIREMENTS

- A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
 1. Local Building Code
 2. Local Electrical Code
 3. NEC National Electrical Code
- B. Other references:
 1. TIA/EIA-568-A - Commercial Building Telecommunications Wiring Standard
 2. EIA/TIA-569 - Commercial Building Standard for Telecommunications Pathways and Spaces.
 3. TIA/EIA-606 - The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
 4. TIA/EIA-607 - Commercial Building Grounding and Bonding Requirements for Telecommunications
 5. TIA/EIA TSB 67 - Transmission Performance Specification for Field Testing of Unshielded Twisted-Pair Cabling Systems.
 6. ISO/IEC 11801 - Generic Cabling Standard
 7. EN 50173 - Generic Cabling Standards for Customer Premises
- C. Governing Codes and Conflicts: If the requirements of these specifications or the Project Drawings exceed those of the governing codes, regulations, and manufacturer installation requirements, then the requirements of these specifications and the drawings shall govern. However, nothing in the drawings or specifications shall be construed to

permit work not conforming to all governing codes, regulations, and manufacturer installation requirements.

1.5 SUBMITTALS

- A. Project Initiation: Within fourteen (14) days of Notice to Proceed, the data network system installer shall furnish the following in a single consolidated submittal:
1. Permits: The Contractor shall obtain all required permits and provide copies to the Owner / Architect / Engineer.
 2. Product Literature: Complete manufacturer's product literature for all material, hardware, and equipment to be used in the installation of the specified system. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner / Designer) and the manufacturer's supporting documentation demonstrating compatibility with other related products shall be included. The submittal shall have some type of distinguishing marker or pointer to indicated what specific product is to be provided
 3. Construction Schedule: A time-scaled Construction Schedule, indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
 4. Specification Compliance: A letter shall be provided stating, by section and subsection, that the SCS installer complies with the entire specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the Owner.
 5. Each Submittal must have a detailed parts list. Quantities will not be required as the quantity of any portion of this system shall be as required for a complete and functional system and in conjunction with the contract documents.
 6. Certifications: The contractor shall submit all certifications for approved products and the certifications must contain dates which are valid from the date of proposal and not expire any sooner than 12 months after substantial completion of the project.
 - a. Physical Security Professional (PSP) Certification: This certification must be held by an on-staff, full-time employee of the system installer. The holder must be staffed out of the office that is located within 75 miles of the project.
 - b. Manufacturer Authorized Dealer Certification must be held by the system installer's office that is located within 75 miles of the project and shall be a company certification, not an individual certification.
 - c. Installer Certifications: Certification indicating that an individual has successfully completed installer training, issued by the VMS and Camera Manufacturers specified herein, must be held by at least 25% of the, on-site, staff and be made available at the site if requested by the owner, architect, and/or project's technology consultant.
- B. Shop Drawings: Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
1. Proposed cable routing and grouping plan.
 2. In addition to the cable routing, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:
 - a. Location of sleeved wall and floor pass-thru
 - b. Size of sleeve at each location installed
 - c. Quantity of cable passing through each sleeve
 - d. Location of devices and head end equipment.

- e. Conduit routing, size, and quantity
- 3. Drawing Compliance: A letter shall be provided stating that the system installer complies with the entire project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the Owner.
- 4. All subcontractors shall provide submittals to general contractor for normal distribution to Architects, Engineers and the Owner's project managers.
- C. At Substantial Completion: Provide drawings, to the Owner, to reflect installed cabling with correct labeling and cable routing.
- D. Close-out Procedures: Two (2) copies of the following documents shall be delivered to the building owner's representative at the time of system acceptance. Close out technology documents shall be separated from all other trade's documents. The close out finals shall include:
 - 1. Inspection and Test Reports: During the course of the Project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed, conform to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
 - 2. Include the Name, address and telephone of the authorized factory representative with a 24-hour emergency service number.
 - 3. The manual shall also include Manufacturer's data sheets and installation manuals/instructions for all equipment installed a list of recommended spare parts.
 - 4. Generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement.
 - 5. An up-to-date record ("as-built") set of approved shop drawing prints that have been revised to show each and every change made to the structure cabling system from the original approved shop drawings. Drawings shall consist of a scaled plan of each building showing the placement of each individual item of the technical cabling system equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway.
 - 6. As-built Drawings shall include cable pathways, camera locations with correct labeling and MDF/IDF locations. A copy of the As-Built drawings reflecting the final locations of all cabling shall be given to the designated Owner's representative. The as-built drawings shall be prepared using AutoCAD 2012 or later. Provide the Owner with electronic versions of the as-builts on CD media.
 - 7. All drawings must reflect final graphic numbering, point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system.
 - 8. A copy of the manufacturer's warranty on the installed system.
 - 9. Any keys to cabinets and/or equipment and special maintenance tools required to repair, maintain, or service the system.
 - 10. Operating and Maintenance Instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction, and shall be provided to the Owner, for their use, in a three-ring binder labeled with the project name and description. (4 copies)
 - 11. Upon completion of the work and at a time designated by the Architect or owner, provide formal training sessions for the Owner's operating personnel to include location, operation, and maintenance of all included systems and equipment.

Minimum amount of training time shall be at least 4 hours.

1.6 QUALITY ASSURANCE

A. Contractor Qualifications:

1. The system installer shall be the authorized representative of the manufacturer to sell, install, and service the proposed manufacturer's equipment. The system installer shall have represented the security alarm manufacturer's product for a minimum of five (5) years' with experience installing and servicing systems of similar scope and complexity and evidence that is completed at least three (3) projects of similar design and is currently engaged in the installation and maintenance of systems herein described.
2. The system installer shall be licensed as required, by the State in which the project is located in, as a security services contractor to design, sell, install, and service security alarm systems.
3. The system installer shall provide 24-hour, 365 days per year emergency service with factory trained service technicians.
4. The installing firm shall have personnel on their staff that has been actively engaged in the business of designing, selling, installing, and servicing security systems for at least ten (10) years.
5. The proposing contractor for this system and the installing contractor of this system shall be of the same organization. Absolutely no subcontracting of any portion of this system by the proposing contractor will be allowed.
6. The proposing/installing contractor of this system must be an authorized dealer / integrator for the project's specified Access Control, Audio / Video Intercom, and the Intrusion Detection systems as well as the system specified in this section.
7. Contractor must be a current integrator of solution in the closest major metropolitan area marketplace, have a permanent office located within 75-miles of the project, and be able to include information on current support staff to be able to service this client.
8. All installation, configuration, setup, program and related work shall be performed by electronic technicians thoroughly trained by the manufacturer in the installation and service of the equipment provided.
9. The system installer shall submit credentials of completed manufacturer certification, verified by a third-party organization, as proof of the knowledge.
10. The Contractor shall provide four (4) current references from clients with systems of similar scope and complexity that became operational in the past three (3) years. At least three (3) of the references shall be utilizing the same system components, in a similar configuration as the proposed system
11. Contractor must be in good standing with the Owner and have no outstanding performance or warranty items at the time of bid. Any outstanding items or issues is grounds to disqualify the Contractor for performing any work on the project.

1.7 PRE-INSTALLATION MEETINGS

- A. No less than a minimum of two weeks prior to rough-in or installation of any system devices, the Installer will be required to attend a pre-construction meeting with the Owner, Architect, and Security Consultant.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.
- B. Handling: Handle materials to avoid damage.

1.9 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.10 SEQUENCING

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.11 WARRANTY

- A. The VSS furnished by the System Integrator including wiring, software, hardware and third-party products shall be fully warranted for parts, materials and labor for a minimum of 1 year from date of the final acceptance.
- B. Manufacturer shall provide a limited 3-year warranty for the product to be free of defects in material and workmanship.

PART 2 -PRODUCTS

2.1 GENERAL

- A. The data cabling to each camera location on this project shall be provided and installed by the data cabling contractor. The security camera installing contractor shall be responsible for the installation of all power wiring for exterior PTZ domes and power supplies.
- B. The Contractor is responsible for providing all incidental and/or miscellaneous hardware not explicitly specified below as required for a complete and operational system.
- C. Materials shall be as listed no alternate products will be allowed without prior consent of the projects security consultant. Any items approved as equivalent products shall be published by addendum ten days prior to proposal for Architect/Engineer review.
- D. All equipment and materials used shall be standard components, regularly manufactured, regularly utilized in the manufacturer's system.
- E. All systems and components shall have been thoroughly tested and proven in actual use.
- F. All systems and components shall be provided with the availability of a toll free 24-hour technical support phone number from the manufacturer. The phone number shall allow for immediate technical assistance for either the dealer/installer or the end user at no charge.
- G. All systems and components shall be provided with an explicit manufacturer warranty.

2.2 DATA CLOSET (MDF/IDF) TERMINATION HARDWARE

- A. Provide and Install new Tripplite, #B030-008-17-IP, NetDirector 8-Port 1U Rack-Mount Console HDMI KVM Switch with 17 in. LCD and IP Remote Access, Dual Rail.
- B. Security contractor is responsible to coordinate with district police technology department on acquiring network connections as well as any network configuration information such as IP numbers that will be required to connect NVR servers to district network.
- C. Security contractor is responsible to provide network cabling connection, either fiber or category 6A, to owner provided network equipment. This connection allows NVR to be connected to owner's local area network.
- D. Security contractor shall provide (1) Minuteman – E2000RTXL2U ups per NVR unit at each rack location to support NVR equipment. Provide 120v. electrical connection at location where NVR is installed.

2.3 CABLE AND INSTALLATION

- A. The Contractor shall provide and install all low voltage plenum rated power cable to exterior PTZ dome camera locations from a central power supply(s). Each power cable shall be individually fused at the power supply so a short in one power cable will blow that

- fuse and not affect the other cameras. The power supply will be UL listed in an approved enclosure. It is the responsibility of the Contractor to size the power supply to handle the full load of the cameras.
- B. The data cabling to each camera location on this project will be provided and installed by cabling contractor certified by Systimax and authorized to install the cable plant and connectivity products. All category 6A cable shall be Systimax Purple 2071 CAT6A.
 - C. Camera contractor is responsible to request and oversee all penetrations and all conduit runs as necessary for installation of CCTV installation.
 - D. All exterior penetrations require necessary weatherproofing to avoid moisture penetration.
 - E. All Cameras will require 10ft purple Cat6A patch chord at camera location and 7ft purple Cat6A patch chord at panel location provided by certified Systimax Data contractor.
 - F. All outdoor cable runs underground shall be in fiber rated for underground use according to Technology specs.
 - G. All power circuits required for the NVR servers are to originate as emergency power from its provided UPS.
 - H. Contractor shall not run any power cabling for any security equipment on rack tray system due to EMI considerations. Contractor shall provide individual cabling support for all low voltage power cabling.
 - I. All cabling for entire project shall be installed at 5'-0" intervals in dedicated support system using a j-hooks support system. Cable supports will be securely attached directly to building structure. Do not attach cabling or supports to ductwork, piping, grid hangers, conduit, or equipment.
 - J. Refer to CFISD structured cabling specifications for Category 6A materials and methods.
 - K. All category 6A cabling shall be routed to existing MDF and IDF locations and be terminated on existing racks. Provide additional patch panels as required and label ports using existing labeling scheme.
 - L. For all cameras that will exceed the maximum category 6A cable limitation the contractor shall provide and install Veracity Outreach Max universal Ethernet and Poe Extender and clearly identify on as-builts. If installed a spare unit will be provided to the owner.

2.4 PROPOSALS

- A. All proposals shall be in the format as shown in the General Conditions Section of the Specification.

2.5 DIGITAL VIDEO RECORDING, MANAGEMENT AND TRANSMISSION SYSTEM

- A. The contractor shall provide and install Network Video Recorders for this project.
- B. Final connection for all new IP cameras shall be provided by the camera contractor. Coordinate all recording settings and functions with owner prior to programming.
- C. Network Video Recorders shall be preprogrammed to include a floor plan graphic of each school and the exact camera locations and name of cameras. Field verification of camera names is required to complete this task.

2.6 EQUIPMENT REQUIRED

- A. Provide a 5 year warranty for all NVR equipment.
- B. Digital Video Recorders:
 - 1. Provide One Seneca Assurance, CT-CFISD-HDMI-RL server per 50 cameras to be installed unless stated otherwise by the owner.
 - 2. The contractor shall coordinate correct Exacq software version prior to submitting or procuring equipment.

3. NVR must have SSA agreement in place for two years at time of install.
4. In response to proposal, contractor shall provide owner with amounts for annual service maintenance agreement that can be purchased after warranty period has expired.

2.7 CAMERAS

- A. Camera Types:
 1. All ceiling mounted cameras shall be surface mounted on the ceiling using ceiling mounting kit and accessible by 10ft ladder.
 2. All cameras shown on the drawings to be corner mounted shall receive corner mount kit by specified camera manufacturer, no exception.
 3. Interior Fixed cameras shall be Bosch Flexidome 5000i or AXIS P3265LV if primary is not available. – TYPE C
 4. Exterior Fixed cameras shall be Bosch Flexidome 5000i or Axis P3265-LVE if primary is not available. – TYPE B
 5. Interior Fish Eye cameras shall be Bosch Flexidome 5100i 6mp. – TYPE E
 6. Multi sensor Interior/Exterior Camera shall be Axis P3727-PLE or Wisenet PNM-C16083RVQ– TYPE A
 7. Duo Cameras shall be AXIS P4707-PLVE Platform with IR or Wisenet PNM-7082RVD if Axis is unavailable. – TYPE D
 8. Axis F9114 and Axis F4105-LRE sensors shall be provided to view around a column or skylight where a center mounted single camera cannot be employed. All F4105-LRE lens must be installed with Axis TU6005 plenum cable accessory. – TYPE F
 9. Specialty PTZ camera will be Axis Q6318-LE PTZ if specifically called for by owner-TYPE G
- B. Field of View Determination by the contractor as necessary for fixed camera locations shall be performed at no additional cost to provide the view desired by the owner. Contractor shall coordinate all final camera views and locations with owner for final approval.
- C. IP camera address scheme will be provided to contractor by the owner. All Camera addresses shall follow the provided scheme and be sequential.
- D. Refer to Drawings for additional camera part numbers, Quantities.
- E. Confirmation of camera type per location requires customer verification.

2.8 ADDITIONAL HARDWARE OR EQUIPMENT REQUIRED

- A. Licensing to be provided for all necessary equipment.
- B. Camera mounts and brackets shall be per camera manufacturer.
- C. One ViewSonic VX3211-2K-MHD 32" LED Monitor is required per NVR.
- D. One of each type of camera used on the project is required upon final inspection for spare replacement equipment.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Fire Wall Penetrations: The Contractor shall avoid penetration of fire rated walls and floors wherever possible. Contractor shall also seal all floor, ceiling and wall penetrations in fire or smoke barriers and in the wiring closet.
- B. Provide three sided pre-finished metal hood and seal to wall where conduit penetrates exterior wall.
- C. Install new conduit on portable pipe supports- (low profile type), as manufactured by Portable Pipe Hangers or Advanced Support Products. Provide roof protection pads under each support. Coordinate location and routing with design engineer prior to rough-in or installation of system.

- D. Do not install wall mounted cameras into metal fascia. Ensure they are mounted into brick, and sealed top sides (Not bottom)
- E. Wall Penetrations:
 - 1. Exterior Penetrations- shall be performed by a certified electrical contractor and be sleeved with metallic conduit and resealed with an Underwriter Laboratories (UL) approved sealant.
 - 2. Interior Penetrations- shall be sleeved with metallic conduit and resealed with an Underwriter Laboratories (UL) approved sealant.
- F. Cable Pathway:
 - 1. In suspended ceiling and raised floor areas where duct, cable trays or conduit are not available, the Contractor shall bundle, in bundles of 25 cables or less, with cable ties snug, but not deforming the cable geometry. Cable bundles shall be supported via “J” hooks attached to the existing building structure and framework at a maximum of five (5) foot intervals. Plenum rated cable ties shall be used in all appropriate areas. The Contractor shall adhere to the manufacturer’s requirements for bending radius and pulling tension of all cables.
 - 2. Cables shall not be attached to lift out ceiling grid supports or laid directly on the ceiling grid.
 - 3. Cables shall not be attached to or supported by fire sprinkler heads or delivery systems or any environmental sensor located in the ceiling air space.

3.2 EQUIPMENT RACK CONFIGURATION

- A. Cable Placement: Cable installation in the wiring closet must conform to the Project Drawings. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance location. Avoid crossing areas horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining a working distance from these openings.
- B. All incoming cables shall be routed on the cable tray and neatly dressed down to the patch panels
- C. Cable shall be routed as closely as possible to the ceiling, floor or corners to ensure that adequate wall or backboard space is available for current and future equipment. All cable runs within the wiring closet shall be horizontal or vertical within the constraints of minimum cable bending radii. Minimum bend radius shall be observed. Cables shall not be tie-wrapped to electrical conduit or other equipment.

3.3 WIRING INSTALLATION

- A. General:
 - 1. Cabling between wiring closet and camera locations shall be made as individual home runs. No intermediate splices may be installed or utilized between the wiring closet and the camera location.
 - 2. All cable must be handled with care during installation so as not to change performance specifications.
- B. Exposed Cable: All cabling shall be installed inside walls or ceiling spaces whenever possible. Exposed cable shall only be run where indicated on the Drawings. Additional exposed cable runs shall require Owner approval, and shall only be allowed when no other options exist. Cabling shall be installed concealed at all times, except in unfinished mechanical rooms or wiring closets where cable shall be installed exposed and located to avoid conflicts with pass-through cabling, etc. Tie wraps shall be used to provide a neat appearance. Provide “D” rings or the appropriate cable guides to dress the cable.
- C. Placement: All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the Owner’s efficient use of their full capacity.

- D. Cable Routes: All cabling placed in ceiling areas must be in conduit, cable tray, or J-Hooks. Cable supports shall be permanently anchored to building structure or substrates. Provide attachment hardware and anchors designed for the structure to which attached and that are suitably sized to carry the weight of the cables to be supported. Attaching cable to pipes or other mechanical items is not permitted. Use J-Hooks for up to 15 cables (Caddy CAT 21 or CAT 32 hooks with appropriate brackets). All runs of sixteen (16) or more cables, provide cable rings on 36" maximum centers to hang cable. Cable shall be routed so as to provide a minimum of 18" spacing from light fixtures, sources of heat, power feeder conduits and EMI sources. Cabling shall not be attached to ceiling grid support wires. Cable runs shall be parallel or perpendicular to building structure. Multiple cables to be banded together every 6 feet.

3.4 DOCUMENTATION

- A. Labels: The Contractor shall label all outlets using permanent machine engraved labels approved by the Owner. Label patch panels in the wiring closet to match those on corresponding camera locations. The font shall be at least one-eighth inch (1/8") in height, block. All labels shall correspond to as-builts and to final test reports.
- B. Contractor shall ensure complete typed labeling of all cameras with numbers that correspond to locations on video server. Labeling system shall correspond to the Owner's labeling system. Verify with Owner. Provide tags (black letters on white labels, plastic coated) on all cables and outlets.
- C. All cables shall be labeled at both ends with a machine label and all terminations shall be stenciled with a typed label for quick circuit identification. Labeling shall conform to TIA/EIA standard 606 and include interconnect cable identification numbers.
- D. A floor plan, clearly labeled with all numbered camera locations, shall be included in the as-built plans.

3.5 CABLE TESTING - BY MANUFACTURER'S REQUIREMENTS

- A. Notification: The Owner/Architect/Engineer shall be notified one week prior to any testing so that the testing may be witnessed.
- B. Final Acceptance: Before requesting a final acceptance, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms and time table for all copper and fiber optic cabling.
- C. Procedures: Trained personnel shall perform all testing. Acceptance of the test procedures discussed below is predicated on the Contractor's use of the recommended products and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation shall be evaluated in the context of each of these factors.
- D. Errors: When errors are found, the source of each error shall be determined, corrected and the cable retested. All defective components shall be replaced and retested. Retest results must be entered on the test results form. All corrections shall be made prior to final acceptance test.

3.6 INSPECTION

- A. Conformance to the installation practices covered above are to be verified when completed. In some cases, the Owner / Architect / Engineer may observe before acceptance.

3.7 WARRANTY

- A. Labor and all other costs as necessary to maintain the equipment in operating condition as intended by the product manufacturer after a period of 1 year shall be negotiated with the owner upon project completion.

- B. Guarantee and warrant all equipment provided for a period of 3 years following date of substantial completion, or a period equal to the stated guaranty/warranty offered by the product manufacturer, whichever is the longest in duration. All such warranties shall include all parts (NVR's, and Cameras).

END OF SECTION

**SECTION 28 3100
INTRUSION DETECTION SYSTEM (IDS)**

PART 1 - GENERAL

1.1 RELATED WORK

- A. The following sections shall associate with this specification as applicable.
 - 1. General Conditions
 - 2. Supplementary Conditions
 - 3. Division 1
 - 4. Division 26 in its entirety.
 - 5. Division 27 in its entirety.
 - 6. Division 28 in its entirety.

1.2 WORK INCLUDED

- A. The Contractor shall furnish and install a complete microprocessor based Intrusion Detection System (IDS) as specified herein. The IDS shall include, but not be limited to, all control equipment, power supplies, power circuits, signal initiating and signaling devices, conduit, wire, fittings, and all other accessories required to provide a complete and operable system.
- B. IDS devices indicated are for reference and coordination purposes only. The installing contractor shall design and provide a complete system, meeting the requirement of specification, The Contractor shall provide all security system devices required for complete system perimeter coverage acceptable to all governing authorities, Architect and Owner.
- C. The IDS shall include intrusion detection coverage as shown on the system floor plans. Whether shown on the floor plans of not, complete coverage of the following areas shall be included:
 - 1. All access points into the building(s), including but not limited to:
 - a. Doors
 - b. roof hatches
 - c. windows
 - 2. Interior space motion detection at the following locations:
 - a. All level 1 spaces with window and/or doors
 - b. All entrances on any level
- D. The IDS shall be the product of a single manufacturer and consist of, but not be limited to the following:
 - 1. Control Panels
 - 2. Field Devices
 - 3. Enclosures
 - 4. Locks and Keys
 - 5. Power Supplies
 - 6. Accessories required to provide a complete IDS
 - 7. System Programming
- E. The IDS installer shall be responsible for, but not limited to:
 - 1. Tagging of all conductors and cables at each end.
 - 2. Provision and installation of IDS control panels.
 - 3. Provision and installation of IDS devices.
 - 4. Full coverage of all windows, doors, roof hatches.
 - 6. Preconstruction meeting with Owner's personnel, installing technician and project superintendent.
- F. The Contractor shall be responsible for identifying requirements for permits, from the local the Local Authority Having Jurisdiction (AHJ), for the installation of the alarm system specified herein and shall assist the Owner in obtaining the relevant alarm permits.
- G. All conduits and back boxes shall be provided and installed by the project's electrical

- contractor. In the event that there is no electrical contractor on the project, responsibility will be that of the IDS installer.
- H. The documents issued for this project are conceptual in nature, including but not limited to specifications and drawings. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer's shop drawings and product data submittals shall represent a complete system, and documents accepted do not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project's Technology Consultant and the Owner.
 - I. Contractor shall integrate all Emergency Eyewash systems into the IDS. Provide cabling connecting both systems. Coordinate with Emergency Eyewash systems contractor.
 - J. Contractor shall connect the Intrusion Detection System to the electrical automatic transfer switch in order to notify the District Police Department when the building is on emergency power. Provide all required cabling and devices for fully functional systems.
 - K. This project is the expansion of an existing intrusion detection system.

1.3 CODES AND STANDARDS

- A. The system shall comply with the applicable Codes and Standards as follows:
 - 1. National Electric Code, Article 760.
 - 2. National Fire Alarm Code (NFPA 72).
 - 3. Life Safety Code (NFPA 101)
- B. Administrative Council for Terminal Attachments (ACTA):
 - 1. ANSI/TIA-968-A-2002 Technical Requirements for Connection of Terminal Equipment to the Telephone Network.
- C. American National Standards Institute (ANSI):
 - 1. ANSI C63.4 Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
- D. California State Fire Marshal (CSFM):
 - 1. Title 19, California Code of Regulations, Building Material Listing Program (BML).
- E. Federal Communications Commission (FCC):
 - 1. Title 47 C.F.R. Part 15; Class B – Radiated and Conducted Emissions.
 - 2. Title 47 C.F.R. Part 68; rules governing the connection of Terminal Equipment (TE) to the Public Switched Telephone Network (PSTN).
- F. The National Institute of Standards and Technology of the United States of America (NIST):
 - 1. Federal Information Processing Standards Publications 197 (FIPS 197) – Advanced Encryption Standard (AES).
- G. International Organization for Standardization (ISO):
 - 1. 9001 - Quality System.
- H. Underwriters Laboratories, Inc. (UL):
 - 1. UL 50 - Enclosures for Electrical Equipment.
 - 2. UL 294 – Access Control System Units.
 - 3. UL 365 - Police Station Connected Burglar Alarm Units and Systems.
 - 4. UL 609 - Local Burglar Alarm Units and Systems.
 - 5. UL 864 - Control Units System for Fire-Protective Signaling System.
 - 6. UL 985 - Household Fire Warning System Units.
 - 7. UL 1023 - Household Burglar Alarm System Units.
 - 8. UL 1076 – Proprietary Burglar Alarm Units and Systems
 - 9. UL 1610 - Central Station Burglar-Alarm Units.
 - 10. UL 60950-1 - Information Technology Equipment - Safety.
 - 11. UL 636 – Hold up alarms
- I. Local & State Building Codes
- J. Requirements of Local Authorities having Jurisdiction
- K. Requirements of American Disabilities Act (Public law 101-336).

- L. Texas Accessibility Standards (TAS)
- M. State Fire Marshall.
- N. State Insurance Code.

1.4 QUALITY ASSURANCE

- A. Contractor Qualifications:
 - 1. The installing contractor shall be the authorized representative of the IDS authorized/certified to sell, install, and service the proposed manufacturer's equipment. The installing contractor shall have represented the IDS manufacturer's product for at least five (5) years.
 - 2. The installing contractor shall be certified to install and setup the IDS software with Security Engine and Access Engine Modules attached.
 - 3. The installing contractor shall be licensed by the State of Texas as a security services contractor to design, sell, install, and service security alarm systems and access control system.
 - 4. The installing contractor shall provide 24-hour, 365 day per year emergency service with factory trained service technicians.
 - 5. The installing contractor shall have personnel on their staff that has been actively engaged in the business of designing, selling, installing, and servicing security alarm systems for at least ten (10) years.
 - 6. The System Installer must submit to the owner prior to starting any work the factory training certificates for all personnel that will be working on the specified IDS. No person is allowed to work on the IDS without proper manufacturer's certification.

1.5 SUBMITTALS AND CLOSE-OUT

- A. Product Data: Within fourteen (14) days of Notice to Proceed, the system installer shall furnish the following in a single consolidated submittal:
 - 1. Permits: The Contractor shall obtain all required permits and provide copies to the Owner / Architect / Engineer.
 - 2. Product Literature: Complete manufacturer's product literature for all system equipment, power supplies, cable, termination components, cable supports, cable labels, field devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner/Designer) and the manufacturer's supporting documentation, demonstrating compatibility with other related products shall be included. The submittal shall have some type of distinguishing marker or pointer to indicated what specific product is to be submitted.
 - 3. Construction Schedule: A time-scaled Construction Schedule indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
 - 4. Specification Compliance: A letter shall be provided stating, by section and subsection, that the system installer complies with the ENTIRE specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been accepted by the project's technology consultant.
 - 5. Certifications: The System Installer shall submit all of the following certifications and the certifications must contain dates which are valid from the date of proposal and not expirer any sooner than 12 months after substantial completion of the project.
 - a. Manufacturer's Authorized Dealer/Installer Certification: This certification must be held by the proposing/installing contractor and state that the proposing/installing contractor is and authorized dealer/installer of the system specified within the project specifications. The certification must have been obtained by the office that is within a 75-mile radius of the

- project's location.
 - b. Installer Certification: This certification must be held by at least 25% of the, on-site, staff and be made available at the site if requested by the owner, architect, and/or project's technology consultant.
 - c. Licenses: This includes all licenses required by the state in which the work is being performed, the federal government, local authorities having jurisdiction, and any organization in that governs the specific system
 - B. Shop Drawings: Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
 - 1. Proposed circuit routing and circuit grouping plan prepared by a system registered designer. The designer's certification must be current. Identifiable, separate routing shall be shown for both the station cabling and any backbone trunk cabling.
 - 2. In addition to the cable routing, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:
 - a. Location of all control equipment and remote power sources
 - b. Locations of all field devices and outlets
 - c. Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)
 - d. Location of sleeved wall and/or floor pass-thru
 - e. Size of sleeve at each location installed
 - f. Quantity of cable passing through each sleeve
 - g. Conduit routing, size, quantity, and stub-up locations for any floor mounted outlets or outlets installed in casework.
 - 3. Drawing Compliance: A letter shall be provided stating that the system installer complies with the entire project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the project's technology consultant.
 - C. Close-out Procedures: For review and acceptance, furnish an electronic copy of the following documents to the Architect / Engineer. Upon acceptance of the submitted close-out documents, provide four (4) copies on an electronic storage media (CD or USD Flash Drive) Labeled with the project name, date of submission, and the name of the submitting firm. Final copies shall be delivered directly to the project's Technology Consultant. The closeout submittals shall include the following and be packaged in a storable container with the physical storage media and any physical items listed:
 - 1. Inspection and Test Reports: During the course of the Project, the System Installer shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed, conform to contract requirements. The System Installer shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The System Installer shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
 - 2. Provide complete test reports for all cabling and devices that comprise system as outlined in this document.
 - 3. Include the Name, address and telephone of the authorized factory representative with a 24-hour emergency service number.
 - 4. The manual shall also include Manufacturer's data sheets and installation manuals/instructions for all equipment installed and a list of recommended spare parts.
 - 5. Generic or typical owner's instruction and operation manual shall not be

6. acceptable to fulfill this requirement.
7. An up-to-date record (“as-built”) set of approved shop drawing prints that have been revised to show each and every change made to the system from the original approved shop drawings.
8. As-built Drawings shall include cable pathways; device locations with correct labeling, control equipment locations, remote power supply locations, cross connect locations, and lightning protection locations. The as-built drawings shall be prepared using AutoCAD 2014 or later.
9. All drawings must reflect point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system.
10. A copy of the manufacturer’s warranty on the installed system.
11. Any keys to cabinets and/or equipment and special maintenance tools required to repair, maintain, or service the system.
12. Operating and Maintenance Instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction, and shall be provided to the Owner, for their use, in a three-ring binder labeled with the project name and description. (4 copies)
13. Upon completion of the work and at a time designated by the Architect or owner, provide formal training sessions for the Owner’s operating personnel to include location, operation, and maintenance of all included systems and equipment. Provide a video copy of the training session as well as all sign in and training sign off sheets
14. One (1) 30” x 42” laminated floor plan sheets illustrating device locations, system wiring configuration, and cable designation. The System Installer shall provide one complete floor plan sheet at each panel location

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS AND INSTALLERS

- A. Acceptable Manufacturer: Bosch Security Systems, Inc.; 130 Perinton Parkway; Fairport, NY 14450. ASD. Toll Free Tel: 800-289-0096. Tel: 585-223-4060. Email: request info (presales.support@us.bosch.com). Web: www.boschsecurity.us.
- B. Substitutions: Not permitted.
- C. Requests for substitutions will be considered in accordance with provisions of Division 1

2.2 CONTROL COMMUNICATOR (Panel)

- A. The IDS control panel shall be Bosch Security Systems, Inc., model # B9512G comprising a fully integrated intrusion, fire, and access control system. The control panel shall support the following:
 1. The IDS system is capable of being utilized as a combination Intrusion and Fire system per code. Fully integrated intrusion, access and fire functions allow users to interface with 1 system instead of 3
 2. Telephone Line Module Interface with programmable options for signaling and supervision.
 3. Conettix IP based communication option provides high-speed, secure alarm transport and control.
 4. 32 programmable areas with perimeter and interior partitioning.
 5. 8 on-board, class B hardwired points with expansion capability for a total of at minimum 500 wired or wireless points.
 6. Compatibility with touch-screen color LCD, vacuum fluorescent, ATM style LCD or LED style Alarm Command Centers.
 7. Local or remote programming, test, and diagnostic capability via a computer running the Remote Programming Software (RPS).
 8. The system shall support the use of an Apple iOS device for control.

- Functions to include arming, disarming, control of outputs, lock, unlock, cycle and secure access doors.
9. Integrated real time clock, calendar, test timer and programmable scheduling capability for relay control and automatic execution of system functions based on a time / event.
 10. Provide 1.4 amps of power for standby operation and 2 amps of alarm power, both rated at 12 VDC.
 11. 2 wet-contact relay outputs and 1 Auxiliary wet-contact relay output with expansion capability for up to an additional 128 dry-contact relay outputs.
 12. Integrated battery charger with reverse hook up protection, battery supervision and battery deep discharge protection.
 13. Supervision of peripheral devices and communications interface(s).
- B. All small installations such as press boxes or tractor sheds shall use Bosch Model #5512 main control panel.
- C. Programmable features shall include:
1. Independently control zones through an independent zone control keypad.
 2. Automatic test reports.
 3. Selective zone shunting.
 4. Custom text on the associated command centers.
- D. Zone Expansion - Expanded to 500 (8 on-board, 492 off-board) individually annunciated points of protection through the addition of a two-wire multiplex zone expansion system (ZONEX). Points of protection are annunciated with custom text at the B915 Command Center and they can be reported to a Radionics D6600Receiver.
- E. User Pass Codes – nine hundred ninety-nine (999) user pass codes shall be available to identify the user when arming/disarming the system.
- F. Protective Circuits shall consist of zones designed for fire and/or panic (holdup, duress, or emergency) and/or burglary and/or supervisory. Each zone represents a protective circuit and shall accommodate normally opened and closed devices with end-of-line resistor supervision. Each of the 500 points are programmable as to whether they are controlled versus 24 hours; interior versus perimeter; instant versus delayed; silent versus audible (and if audible, pulsed or steady); and local or reporting.
1. Additional programmable parameters for each point include the ability to suppress trouble or restoral reports, designate it as a priority zone (system cannot be armed if this point is off-normal), report two separate telephone numbers and provide for automatic shunting of points from the system in the event that the detection device malfunctions and creates numerous false alarms.
 2. Each POPIT shall accommodate normally opened and normally closed devices with end-of-line resistor supervisor.
 3. Minimum total points, 500.
- G. Entry/exit delays shall be independently programmable from 10 to 150 seconds. A pre-warn audible shall be coincident with the entry delay.
- H. Programming of all system functions shall be achievable at system site or remotely via the use of the dial-up telephone network. Minimum programmable functions shall include:
1. User pass codes, entry/exit delay times, master zone personality, day/date/time, telephone numbers, point of protection text labels, and bell time.
 2. A programmable system pass code shall be used to prevent unauthorized remote programming attempts.
 3. Remote programming capability shall be automatic or require user enabling at the discretion of the user.
- I. Remote control via the use of the dial-up telephone and owner's local area network shall include:
1. System arming.
 2. Reset of audible signals.
 3. Activation/deactivation of relay contacts.

4. Interrogation of battery.
5. Zone and armed status.
6. Enable/disable of reporting functions and removing reporting devices for servicing while the remainder of the system is operative.
- J. Recognitions shall include: UL for central station fire and/or burglary, local burglary and/or fire; FM for fire, California Fire Marshal for fire; and NYBSA for fire.
- K. Miscellaneous built-in features shall include:
 1. Real-time clock.
 2. Interrogator.
 3. Auto-answer modem.
 4. Phone line monitor.
 5. Loop start/ground start telephone interface.
 6. Auto bell test.
 7. Lug-in terminal strips, and user controlled zone bypass.
- L. Command centers shall be microprocessor-based
 1. 16 character illuminated alpha-numeric display.
 2. Burglary and fire sounders.
 3. Backlight 15-key touchpad.
 4. Pre-warn tone.
 5. The arming station shall have the ability to annunciate the English language format via the 16 character alphanumeric display by the following:
 - a. Master zone (alarm, service, faulted, and function), POPIT (alarm, service, faulted, missing, extra, function, and location), arm/disarm status (system diagnostics, time/day/date, and userprompts).
 6. Additional features shall include local system test, sensor reset, panic and/or medical and/or duress alarm initiation, independent master zone by-pass with automatic restoration to normal status to next system arming, perimeter watch mode, user changeable pass codes, remote programming initiation, and system/monitoring service test.
 7. Radionics model B915, and shall be functional at each of the locations shown on the floor plans.
 8. Non-school oriented buildings will use Radionics Model B942 Touch Screen Keypads
- M. Modules and Accessories
 1. POPEX Module (Zone Expansion B299)
 2. B8103 Main Panel Enclosure & D101 Lock set- one required for the main panel and one for each quadrant of the project receiving a B299.
 3. D9002-5 6 location 3 hole Mounting plate- adapter used for hanging modules in all expansion panels.
 4. B430 Telephone Line Interface
 5. B308 Octo-Relay module - provides eight form "C" dry contact relay outputs for a variety of programmable responses to alarm, trouble and other system conditions.
 6. Auxiliary power supplies as required for powering of motion detectors, Altronix Power Supply (Part # SMP10PM12P8) - one required for each quadrant of the project receiving a B299.

2.3 FIELD DEVICES

- A. Ceiling mounted 360 Degree, infrared sensors / microwave motion sensors. Model DS9370
 1. Bracket for direct mounting to standard 3-1/2" and 4" electrical back boxes.
 2. All units must be adjusted/masked to reduce false signals for the covered area.
 3. Contractor to provide a dedicated POPIT for each motion detector on the project.
- B. Ceiling mounted 200ft Long Range infrared sensor. Model DS794Z

1. Bracket for direct mounting to standard 3-1/2" and 4" electrical back boxes.
 2. All units must be adjusted/masked to reduce false signals for the covered area.
 3. Contractor to provide a dedicated POPIT for each motion detector on the project
- C. Wall mounted, high performance, Tri Tech PIR/Microwave sensor, Model ISC-CDL1-W15G
1. Bracket for direct mounting to standard 3-1/2" and 4" electrical back boxes.
 2. All units to have areas of coverage, which would cause false alarm signals to be generated, masked out and adjusted to reduce false signals.
 3. Provide model correct protective wire cage in gymnasiums.
 4. Contractor to provide a dedicated POPIT for each motion detector on the project.
- D. Magnetic Door / Hatch / Overhead Contacts
1. Recessed contact shall be Bosch ISN-CSD70-W to be used in all storefront door frames. 1840-N magnet or like to be used in locations where door frame dictates its necessity.
 2. Surface mount contacts are to be Bosch ISN-CSM35W or appropriate color to match the frame.
 3. Mechanical Door/Roof Hatch contacts shall be model Sentrol 2505A-L contact. The leads must pass through a back box by the correct size twin screw clamp connector.
 4. Overhead Roll up contacts shall be model Ademco 958 contact
 5. Contractor to provide a dedicated POPIT for each entry door, set of doors, roof hatch or rollup door on the project.
- E. Glass Break Detector
1. Bracket for direct mounting to standard 3-1/2" and 4" electrical back boxes.
 2. Provide model correct protective wire cage in gymnasiums.
 3. Glass breaks shall be Model GE 5812-RND or Bosch DS-1108DI
 4. Contractor to Provide dedicated POPIT for each room of glass break detectors on the project.
- F. Sirens
1. Shall be installed on Wall / Ceiling within 50 foot of every keypad location.
 2. Wired directly to corresponding relay module and not the main control panel.
 3. Sirens shall be Model SSX-52 Amseco.

2.3 WIRING

- A. All wiring shall be by the manufactures (Bosch/Radionics) specifications. All cable is preferred but not limited to be shielded.
- B. Each area of a building shall provide its own Popex Module(s), Power supply(ies) and enclosure(s) in that areas IDF. All areas considered should be at minimum 500ft from the main panel or as otherwise instructed by owner.
- C. Coordination with the electrical contractor is the responsibility of the Security Contractor to ensure all conduit is in place for a complete installation.
- D. All systems shall be connected to an emergency power source.
- E. Color code of all security intrusion detection system and access control wiring shall be purple in color.
- F. Approved Products:
 1. 18/2 unshielded:
Belden #6300UE0071000
Tappan Wire & Cable, Inc. #P40020.122
 2. 18/4 unshielded:
Belden #6302UE0071000
Tappan Wire & Cable, Inc. #P41387.28
 3. 18/6 unshielded:
Belden #6304UE0071000
Tappan Wire & Cable, Inc.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All wiring shall be in accordance with the National Electrical Code, Local Codes, and article 760 of NFPA Standard 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings
- B. All wire shall be UL Listed CL2 for limited energy (300V) applications and shall be installed in conduit. Limited energy MPP wire may be run open in return air ceiling plenums provided such wire is UL Listed for such applications and is of the low smoke producing fluorocarbon type and complies with NEC Article 760 if so approved by the local authority having jurisdiction.
- C. No AC wiring or any other wiring shall be run in the same conduit as security alarm wiring.
- D. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" not to exceed 40% per NEC.
- E. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
- F. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations such as inside walls, all mechanical / electrical rooms, or other areas where wiring might be exposed or subject to Damage.
- G. All vertical wiring and all main trunk / riser wiring shall be installed in a complete raceway / conduit system. All riser boxes shall be adequately sized for the number of conductors transversing the respective box as well as the number of terminations required.
- H. Provide a Green Systimax Category 6 telephone cable from the Master Control Panel to the Telephone Equipment room.
- I. (2) 18-4 wires will be run from the panel to the prior designated future portable connection location and labeled in plain English on both ends. These spares are to be left above the ceiling with 10ft of slack at minimum.
- J. Each set of glass breaks that protect one room are to be connected through one POPIT module for point identification of that room.
- K. Magnetic door contacts protecting separate hallways or entries are to be connected into separate POPIT modules for separate identification.
- L. Provide and install (1) dedicated POPIT for each device installed on the project including but not limited to glass break detectors.
- M. All POPIT Modules shall be installed inside a 4"x4" junction box with a cover to be mounted on the wall nearest to the device the POPIT Module is associated with. All boxes shall be labeled with the appropriate corresponding point contained within.
- N. Integrate the security system to the remote monitoring station. Provide all hardware and cabling as required. Coordinate with Owner for approved remote monitoring service.
- O. All POPIT modules on project shall be mounted above drop ceiling in an area easily accessible by an 8 or 6 ft ladder.
- P. All keypads, sirens and POPEX modules shall have dedicated homeruns from each device to the master control panel. Do not daisy chain keypads or sirens. Chaining of modules is permitted if location serves multiple areas of coverage.
- Q. All POPIT modules and power supplies are required to be located on as-built drawings delivered to owner at or before substantial completion of project.
- R. Contractor shall install communication wire from provided exterior connection at freezer/cooler control panels to burglar alarm via POPIT module interface to notify panel should freezer/cooler encounter high temperature condition. Coordinate programming and testing of module with owner.
- S. All POPEX modules and power supplies shall be installed in IDF closets for that area of coverage with easy accessibility and a dedicated SDI2 homerun to the master control panel not to exceed 500ft.
- T. All device power runs shall be fused and clearly labeled in plain English at each main power source.

- U. All Eyewash stations and Lockdown buttons shall have a dedicated POPIT module interface per device on the project and be wired Normally closed for monitoring purposes.
- V. Any generator on site must be monitored through a dry Normally closed contact connection to a dedicated POPIT module and tested to confirm its function for main building AC Loss.

3.2 CABLE PATHWAYS

- A. Cable Support:
 - 1. All wire not installed inside conduit or a designated cable tray system shall be installed in a dedicated cable support system for the entire run of each cable. Including, but not limited to service loops.
 - a. Approved Cable Support Manufacturer:
Panduit Corporation
Erico/Caddy
B-Line
Supports shall be sized appropriately for the number of wires being supported. Reference the manufacturer's specifications for the suggested maximum cables per support size.
 - 2. The approved cable support system shall be attached directly to the building steel at a serviceable height. In the event that the building steel is not 5' of the finished ceiling, the contractor shall provide a dedicated threaded rod extending within 5' of the finished ceiling and mount the cable support hook to the treaded rod.
 - 3. The cable support shall be installed at a maximum of 5' on center.
 - 4. All cable installed shall be attached to the cable support system with plenum rated Velcro and a plenum rated Velcro tie shall be installed between each cable support, to keep wires neatly bundled throughout the entire run. Tie wraps will only be allowed to be used inside the control panels as required to manage the wires within each type of panel.
 - 5. Absolutely no cable, not installed in conduit, will be allowed to be attached directly to the building's steel or supported in any other method than that stated above.
 - 6. It is the responsibility of the installing contractor to coordinate with all other trades on the project to insure that the pathway of this system does not interfere with the installation of the other trades and to prevent the installed product of other trades from putting strain on the installed wiring.
- B. Conduit / Raceway:
 - 1. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
 - 2. Conduit and raceway system shall be installed as specified under the general electrical section of the specifications, and per NEC.
 - 3. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
 - 4. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.

3.3 SYSTEM OPERATION

- A. When an alarm condition is detected by any of the alarm initiating devices, the following functions shall occur:
 - 1. The system keypad's interior audible device shall sound until silenced by using proper security code or after system time out.
 - 2. A custom system alarm message shall be displayed on the LCD display. This display will show the alarm device location in plain English. Location and partition custom messages shall be field programmable.

3. The remote signaling tie connection shall be activated at the Owner's approved central security monitoring location and/or other Owner designated location.
4. Printer shall provide printed copy of events recorded in logger. Install adjacent to security panel.

3.4 SYSTEM ZONING AND PARTITIONING

- A. The system shall employ intelligent initiating devices and interface devices capable of being recognized and enunciated at the main system keypad and devices partition keypad.
- B. All zoning/device locations shall be field programmable.
- C. Input control zones shall be coordinated with the owner prior to final programming:

3.5 TESTING

- A. Submit a written test report from an authorized representative of the equipment manufacturer that the system has been 100% tested and approved. Final test shall be witnessed by Owner, Engineer, Electrical Contractor and performed by the equipment supplier. Final test report must be received and acknowledged by the Owner prior to substantial completion.
- B. Provide instruction as to proper use and operation of system, for the Owner's designated personnel.

3.6 WARRANTY

- A. Entire system shall be warranted against defects in materials and workmanship for a period of one (1) year from the date of substantial completion.
- B. Any Extended Manufacturer's Warranty will be provided to the Owner if the Sub-contractor entitled to the job has an agreement for an extended warranty already in place with the Manufacturer.

3.7 SOFTWARE

- A. Provide two electronic copies of the final programming and program software to the Owner's Police Technology Foreman after final approval.

END OF SECTION

SECTION 28 4602
EXPANSION OF EXISTING FIRE DETECTION AND ALARM SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide all detailed engineering, documentation, materials and devices, installation, calibration, software programming and check-out necessary for a complete and fully operational fire detection and alarm system in accordance with the full intent and meaning of the drawings and specifications including, but not limited to, the following:
 - 1. Supply, install and connect all hardware necessary to provide a complete and operational fire detection and alarm system.
 - 2. Supply, install and wire all field hardware, power supplies, power circuits, alarm initiating devices, audible and visual alarm devices, auxiliary control relays, signal initiating and signaling devices, conduits, wires, fittings and all accessories required for the system to perform as specified as required. Use and expand the existing fire alarm control panel.
 - 3. Supply, install, debug and test all software required to provide all software functions described in accordance with the full intent and meaning of the drawings and specifications.
 - 4. Coordinate the work specified under this Section with other trades and contractors to assure a complete and fully operational system.
- B. The intent of fire detection and alarm system work is specified in this section and indicated on the drawings. The installing contractor shall design and provide a complete system, meeting the requirement of this section. The Contractor shall provide all fire alarm and initiation devices in new and renovated areas required for a complete system acceptable to all governing authorities. Provide proper spacing and coverage of all devices.
- C. This is an expansion of the existing system to a voice evacuation system. Portable buildings are included in scope. Existing pull stations shall be removed other than pull station locations at FACP and FAA. Contractor shall remove pull station protective plastic covers and wall anchors. Existing pull stations in portable buildings are to remain. Contractor shall provide and install a uduct card to enable fire alarm system point to point monitoring.

1.2 RELATED SECTIONS

- A. Divisions 22, 23 and 26
- B. Fire Suppression Systems
- C. Elevators
- D. Food Service

1.3 CODES / STANDARDS / REFERENCES (LATEST EDITIONS)

- A. National Fire Protection Association (NFPA):
 - 1. NFPA 1 Fire Code
 - 2. NFPA 13 Systems, Installation
 - 3. NFPA 17 Dry Chemical Extinguishing Systems
 - 4. NFPA 70 National Electrical Code
 - 5. NFPA 72 National Fire Alarm and Signaling Code.
 - 6. NFPA 80 Fire Doors and Fire Windows
 - 7. NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems.
 - 8. NFPA 92A Smoke Control Systems
 - 9. NFPA 101 Life Safety code.
 - 10. NFPA 105 Smoke Control Door Assemblies

- 11. NFPA 1221 Standard for the Installation, Maintenance and Use of Emergency Services Communications Systems.
- 12. NFPA 2001 Fire Extinguishing Systems, Clean Agent

- B. UL: Underwriters Laboratories, Inc.
 - 1. 217 Single and Multiple Station Smoke Detectors.
 - 2. 268 Smoke Detectors for Fire Protective Signaling Services.
 - 3. 864 Control Units for Fire Protective Signaling Services.
 - 4. 864 Transient protection
 - 5. 1480 Speakers for Fire Protective Signaling Systems
 - 6. UL Fire Protection Equipment Directory.
 - 7. UL Electrical Construction Materials Directory.
- C. Factory Mutual P7825 Approval Guide
- D. American National Standards Institute (ANSI).
- E. National Electrical Manufacturer's Association (NEMA).
- F. Institute of Electrical and Electronic Engineers (IEEE).
- G. Electronic Industries Association (EIA-232-C): Interface between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Interchange.
- H. Requirements of American Disabilities Act (Public Law 101-336).
- I. Local Accessibility Standards, Codes, and Ordinances
- J. State Fire Marshall or Requirements of Local Authorities having Jurisdiction
- K. State Insurance Code.
- L. National Building Code.
- M. International Building and Fire Code adopted by Local Authority Having Jurisdiction
- N. Uniform Building Code.
- O. Local & State Building Codes.
- P. In addition the above requirements, comply with all local codes. Where discrepancies exist between codes, drawings or specifications, the more stringent requirement shall prevail. Installation shall be subject to approval, inspection and test of applicable regulatory agencies.

1.4 MANUFACTURER'S, PLANNER'S AND INSTALLER'S QUALIFICATIONS

- A. The manufacturer shall regularly and presently produce, as the manufacturer's principle products, the equipment and material of the type and design specified for this project, and shall have manufactured the item for at least 5 years. All components of the system shall be UL compatible with the existing main fire alarm control panel. Manufacturer of all components shall match existing manufacturers of similar or same type components unless otherwise specified or noted on the drawings.
- B. The installing contractor shall have been actively engaged in the business of designing, selling, installing, and servicing fire alarm systems for at least ten (10) years.
- C. The entire Fire Detection and Alarm System shall be installed by a factory authorized representative of the existing main fire alarm control panel and certified by the manufacturer to distribute, sell, and install the specified fire alarm and smoke detection system. Include all components, elements, and testing and acceptance procedures.
- D. If the submitted system is being supplied by an authorized distributor of the equipment manufacturer, the distributor shall have been actively engaged in the sale, installation and service of the type of system proposed for this project for a minimum of 10 years.
- E. Any proposed installer who cannot show evidence of such qualifications may be rejected. The services of a technician provided and certified by the equipment manufacturer shall be provided to supervise the installation and tests of the system.
- F. Furnish evidence there is an experienced and effective service organization, which carries a stock of repair parts for the system to be furnished.

- G. The installing contractor shall be licensed by the State Fire Marshall to design, sell, install, and service fire alarm systems as required by the State Insurance Code.
- H. The installing contractor shall have on his staff a minimum of two (2) Fire Alarm Planning Superintendent (APS) licensed by the State Fire Marshall's office for such purpose and under whose supervision installation, final connections, and check out will take place as required by the State Insurance Code.
- I. The APS shall be a certified NICET Level III state licensed fire alarm planner under whose supervision system design shall take place. In lieu of a NICET certified state licensed fire alarm planner, the contractor or supplier may provide design supervision by a registered professional engineer, who regularly engages in the design of fire alarm systems.
- J. The installing contractor shall provide 24-hour, 365 days per year emergency service with factory trained, state licensed service technicians.
- K. Material shall be new and in perfect condition when installed.
- L. Electrical or electronic equipment provided under this Division which has been damaged, exposed to weather, or is, in the opinion of the Architect/Engineer otherwise unsuitable because of improper fabrication, storage, or installation, shall be removed and replaced with new equipment, at no additional cost to the owner.

1.5 COORDINATION

- A. It shall be the responsibility of the installing contractor to coordinate all requirements surrounding installation of the fire alarm system with all other trades.

1.6 DEFINITIONS

- A. General: Wherever mentioned in this specification or on the drawings, the equipment, devices and functions shall be defined as follows:
 - 1. Alarm Signal: A signal, which signifies a state of emergency requiring immediate action and immediate notification of the Fire Department. These are signals such as:
 - a. The operation of a manual station.
 - b. The operation of a fire suppression system switch.
 - 2. Pre-Alarm Signal: A signal, which indicates a detection device, has operated. These signals require and immediate response, but do not require immediate notification of the Fire Department.
 - 3. Supervisory Signal: A signal, which signifies the impairment of fire protection system, which may prevent its normal operation.
 - 4. Trouble Signal: A signal, which indicates that a fault, such as an open circuit or ground, has occurred in the system.
 - 5. Alarm Zone: An alarm initiating device or combination of devices connected to a single alarm initiating device circuit.
 - 6. Pre-Alarm Zone: A detector or group of detectors connected to a single detector circuit, which can send an alarm to the central control panel.
 - 7. Supervision Zone: A supervisory signal initiating device or combination of such devices connected to a single supervisory signal circuit.
 - 8. Communication Zone: A fire alarm indicating device or series of devices arranged to visually and/or audibly indicate a fire alarm signal.

1.7 SUBMITTALS

- A. Before the shop drawings are submitted to Architect / Engineer, submit drawings to the Authority Having Jurisdiction for approval. All approvals shall be noted on the drawings or by letter from the Authority Having Jurisdiction. Submit copies of the Authority Having Jurisdiction approved shop drawings to the Architect for review.
- B. Fire alarm submittal shall be bound and separate from all other submittals. The installing

contractor and/or equipment supplier shall provide complete and detailed shop drawings and include:

1. Provide a complete written, item-by-item, line-by-line, specification review stating compliance or deviation in full description.
2. Complete point-to-point wiring diagrams of new equipment.
3. Complete floor plan drawings locating all new system devices and existing panels used for expansion.
4. Complete system bill of material.
5. Detailed system operational description. Any specification differences and deviations shall be clearly noted and marked.
6. Provide a complete description of system operation.
7. Manufacturer's installation instruction.
8. Bound form with contractor's name, supplier's name, project name, state fire alarm license, Fire Alarm Planning Superintendent license and all Technician(s) license adequately identified.
9. Submittal sheets sequentially numbered with the format: sheet number of number total. For example: 1 of 3.
10. Complete set of manufacturer's operating instructions, circuit diagrams and the information necessary for proper installation, operation and maintenance.
11. Field and factory wiring diagrams of all new systems and for typical devices showing all connections with all terminals and interconnections identified.
12. Complete schematic circuit diagrams for all new equipment, including panel modules.
13. Floor plan drawings including all existing main and new panel and device locations, conduit sizes between devices and panels; number, size and type of conductors between devices and panels; walls, doors and graphic room numbers; exact power requirements and conduit routing with the location of all junction boxes and exact locations of devices and equipment. Submit a floor plan drawing circuiting/zoning shall be identified on the drawings.
14. Complete wiring, routing, and schematic diagrams, software descriptions, and details required to demonstrate that the system has been coordinated and will function as a system.
15. Manufacturers catalog cut sheets shall be provide for each piece of equipment with the appropriate model or part number highlighted in cases where multiple model numbers or part numbers are shown.
16. Detailed list of all hardware components, which are included.
17. Installation details for each type of field mounted device installed under this contract.
18. Point-to-point termination schedules with cable identification numbers and terminal strip numbers.
19. New fire detection and alarm system's panel configuration complete with peripheral devices, batteries, power supplies, and interconnection diagrams.
20. Submit a riser diagram of trunk wiring and device-to-device wiring and device to fire alarm control panel wiring. Riser shall show:
 - a. Conduit sizes and types.
 - b. Number, size and type of conductors.
 - c. Fire detection and alarm devices arranged in the required circuiting/zoning, as defined in the specifications and on the drawing.
 - d. Battery calculations to show compliance with the requirements of the specifications for both alarm and supervisory mode.
21. Indicate visual alarm device candela setting required for coverage.
22. Sample of proposed graphic/text annunciation.

1.8 OPERATION AND MAINTENANCE MANUALS

- A. Submit complete sets of operation and maintenance manuals. Manual, less as-builts, and sign-off sheets, shall be provided upon completion of the work. Approval of the manual will be required prior to substantial completion.
- B. The Operation and Maintenance Manual shall consist of the following:
 - 1. The manual shall include the names, addresses and telephone numbers of each Contractor installing products, and of the nearest service representative for each product. The manual shall have a Table of Contents and tab sheets. Update manuals to include modifications made during installation, checkout and acceptance. The manual shall include the sections described in the following paragraphs.
 - 2. The Functional Design Section shall identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. Hardware and software functions, interfaces, and requirements shall be provided for system operating modes.
 - 3. The Hardware Section shall describe equipment provided, including general description and specifications, installation and checkout procedure, electrical schematics and layout drawings. Alignment and calibration procedures, manufacturer's repair parts list indicating source of supply, interface definition, signal identification and wiring diagrams. Also, include a complete parts list of all components as well as a list of recommended spare parts. The spare parts list shall include, for each item, the manufacturer's name, the model of the part, and serial number, if appropriate, and a physical and electrical description of the part.
 - 4. The Software Section shall describe programming and testing, starting with a system overview and proceeding to a detailed description of each software module, to instruct the user on programming or reprogramming any portion of the system and other information necessary to enable proper system usage.
 - 5. The Operation Section shall provide instructions for operation of the system, including system start-up procedures, use of system and applications software, alarm presentation (where applicable), failure and recovery procedures, preventive maintenance schedule, parameter schedules and sequence definition, and system access requirements.
 - 6. The Maintenance Section shall provide descriptions of maintenance for equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.
 - 7. The Shop Drawings section shall include copies of all approved shop drawings and submittal materials updated to "AS BUILT".

1.9 AS-BUILT DRAWINGS

- A. Prepare and submit detailed "As-Built" drawings. The drawings shall include certified test of the system, testing and acceptance sign-off sheets, and other items specified elsewhere to be performed after initial submission of operation and maintenance manuals, complete wiring diagrams showing connections between all devices and equipment, both factory and field wired. Include a riser diagram and drawings showing the as built location of all devices and equipment. The drawings shall show the system as installed, including all deviations from both the project drawings and the approved shop drawings. The drawings shall be prepared on uniform sized sheets, the same size as the project drawings. The plan drawings shall be 11x17 inch and inserted in the specified Operations and Maintenance Manuals. Provide electronic copies in PDF and Autocad.dwg format.

1.10 WARRANTY

- A. All new fire alarm devices, new panels, new equipment and new accessories, including

- labor and material, shall be free from defects in workmanship and materials, under normal use and service, for a period of one year from the date of substantial completion. Any equipment or workmanship shown to be defective shall be repaired, replaced or adjusted during normal working hours at no cost to the owner within 4-hour notification.
- B. Repair services and replacement parts for the system to be furnished under this Contract shall be available for a period of ten years after the date of final acceptance. Service during the warranty period shall be provided within four hours after notification and all repairs shall be corrected within 24 hours after notification throughout the warranty specified in this section.
 - C. The installing contractor shall provide 24 hour, 365 days per year emergency service with factory trained, state licensed service technicians.
 - D. The equipment manufacturer shall be represented by a local service organization and the name of such shall be furnished to the Owner, Architect, and Engineer.
 - E. Provide a certified fire alarm test of the complete system at the end of the warranty period and correct any and all items located in the area of renovation to bring the system to an approved status at no cost to the Owner. Clean all smoke detectors and replace all defective parts within the area of renovation at no cost to the Owner.
 - F. Guarantee labor, materials, and equipment provided under this contract against all defects for a period of one year after the date of final acceptance and receipt and approval of "As-Built" drawings and schematics of all equipment.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers acceptable contingent upon Products' compliance with the specifications:
 - 1. Match Existing main fire alarm panel manufacturer.
 - 2. Existing Fire Alarm Panel is Notifier NFS2-3030

2.2 SYSTEM DESCRIPTION

- A. System shall be a fully functional fire detection and alarm system, tested and left in first class operating condition. Voice evacuation systems where required or specified shall have voice alarm notification wherever audible notification is required.
- B. The system shall provide communication with initiating and control devices individually. All of these devices shall be individually annunciated at the fire alarm control panel. Annunciation shall include the following conditions for each point:
 - 1. Alarm
 - 2. Trouble.
 - 3. Open
 - 4. Short
 - 5. Device missing/failed.
- C. System circuits shall be wired as follows: Initiating device circuit (IDCs) shall be Style B, indicating appliance circuit (IACs) shall be Style Y, and signal line circuit (SLCs) shall be Style 4 as describe in NFPA 72.
- D. The system shall contain independently supervised initiating device circuits. The alarm activation of any initiation circuit shall not prevent the subsequent alarm operation of any other initiation circuit.
- E. There shall be supervisory service initiation device circuits for connection of all sprinkler water flow switches and valves. Device activation shall cause a general alarm at the fire alarm control panel. Each flow and tamper switch shall have an individual address.
- F. There shall be independently supervised and independently fused indicating appliance circuits for all alarm signaling devices. Disarrangement conditions of any circuit shall not affect the operation of other circuits.
- G. Auxiliary manual controls shall be supervised so that an "off normal" position of any

- switch shall cause an “off normal” system trouble.
- H. The incoming power to the system shall be supervised so that any power failure must be audibly and visually indicated at the fire alarm control panel. A green “power on” LED shall be displayed continuously while incoming power is present at the building fire alarm control panel.
 - I. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visually indicated at the building fire alarm control panel.
 - J. The system modules shall be electrically supervised for module placement. Should a module become disconnected, the system trouble indicator shall illuminate and the audible trouble signal shall sound.
 - K. The system shall have provisions for disabling and enabling all circuits individually for maintenance or testing purposes.
 - L. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal or supervisory mode for a period of 24 hours with 20 minutes of alarm operation at the end of this period as a minimum. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic. If batteries are fully discharged, the charger shall recharge them back to full charge in four hours.
 - M. All external circuits requiring system operating power shall be 24 VDC and shall be individually fused at the respective fire alarm control panel.
 - N. All addressable devices shall have the capability of being disabled or enabled individually from the fire alarm control panel.
 - O. A maximum of 90 addressable devices shall be multi-dropped from a single pair of wires. Systems that require factory reprogramming to add or delete devices within the capability of the designed system are unacceptable. Expansion of the designed system shall be accomplished by factory reprogramming.
 - P. The communication format to the addressable devices shall be a completely digital poll/response protocol to allow t-tapping of the circuit wiring. A high degree of communication reliability must be obtained by using parity data bit error checking routines for address codes and check sum routines for the data transmission portion of the protocol.
 - Q. Each addressable device must be uniquely identified by an address code. The system must verify that proper type device is in place and matches the desired software configuration. All remote or external panels shall have an individual address for monitoring.
 - R. Wiring type, distances, survivability, and wiring configuration types shall be approved by the equipment manufacturer. The system shall allow a line distance of up to 2,500 feet to the furthest addressable device on a Style Y circuit. Fire alarm cable shall have an outer jacket insulation color of red. Minimum wire size shall be #18 AWG.
 - S. Each panel extender shall have an individual address.

2.3 FIRE ALARM CONTROL PANEL (FACP)

- A. Existing to remain.
- B. The fire alarm control panel shall be left with 25% spare initiating point and battery capacity for future use.
- C. New power supplies (if required) shall provide all control panel and peripheral power needs with filtered power as well as unregulated 24VDC power for external audio-visual devices. The audio-visual power shall be increased as needed by adding additional modular expansion power supplies. All power supplies shall be designed to meet UL and NFPA requirements for POWER LIMITED operation on all external signaling lines, including initiating circuits and indicating circuits. Design the system power supplies and

power trunk wiring for all annunciation devices required, and to add a minimum of two (2) 110cd visual devices in the future. Individual circuit design loading shall not exceed 70% of power supply and system wiring capacity when including the additional spare capacity for the 110cd visual devices

1. Input power shall be 120VAC 60Hz. The power supply shall provide internal supervised batteries and automatic charger. The power supply shall provide positive and negative ground fault supervision, battery/charger fail condition, and AC power fail indicators. The power supply shall also provide supervision of modular expansion power supplies as may be required.
2. Surge protection shall be integral to the control panels.
3. Each power supply shall be monitored and have an individual address.

2.4 DIGITAL FIRE ALARM COMMUNICATOR

- A. Existing to remain.

2.5 EMERGENCY VOICE ALARM COMMUNICATION SYSTEM

- A. Existing to remain.
- B. Compatible and UL listed with existing fire alarm system.

2.6 NEW FIELD DEVICES WHERE REQUIRED

- A. All devices shall be supervised for trouble conditions. The fire alarm control panel shall be capable of displaying the type of trouble condition (open, short, device missing/failed). Should a device fail, it shall not hinder the operation of other system devices.
- B. Visual Signals
 1. Strobe lights shall be low profile and operate on 24 VDC. The strobe light shall be capable of producing 75 candela on axis to comply with ADA and UL 1638 requirements, and 15, 30, or 110 candela to comply with UL 1971 requirements. Visual signals in common areas of illumination shall have synchronized flash. Provide white with red letters.
 2. All wall mounted strobe units installed in student's toilets, gymnasiums, corridors, student locker/dressing rooms shall have a protective cover.
- C. Combination Alarm Signal and High Intensity Visual Signals
 1. Strobe lights shall operate on 24 VDC. The strobe light shall be capable of producing 75 candela on axis to comply with ADA requirements, and 15, 30 or 110 candela to comply with UL 1971 requirements. Visual signals in common areas of illumination shall have synchronized flash. Each unit shall provide a Code 3 Temporal tone. The horn shall be capable of an output of 95dB at 10', and intensity adjusted accordingly for the area of coverage. Electronic Mini-Sounder or horn set on low setting shall be provided in interior rooms 900 square feet or less. Mini-sounder shall not be used in any corridors, mechanical electrical rooms and similar large spaces and areas of high ambient noise level. Provide white with red letters.
 2. All wall mounted combination units installed in student toilets, gymnasiums, corridors, student locker/dressing rooms shall have a protective cover
 3. The audible emergency alarms shall produce a sound that exceeds the prevailing sound level in the room or space by at least 15 dba or shall exceed any maximum sound level with a duration of 60 seconds by 5 dba, whichever is louder. Sound levels for alarm signals shall not exceed 110 dba at the minimum hearing distance from the audible appliance.
- D. Exterior Audible Signal:
 1. Semi-flush mounted, molded of high impact red thermoplastic and listed for weatherproof locations.
- E. Combination Voice Signal and High Intensity Visual Signals (where indicated or required

- by local AHJ):
1. Strobe lights shall operate on 24 VDC. The strobe light shall be capable of producing 75 candela on axis to comply with ADA requirements, and 15, 30 or 110 candela to comply with UL 1971 requirements. Visual signals in common areas of illumination shall have synchronized flash.
 2. All combination units installed in student toilets, gymnasiums, student locker / dressing rooms shall have a protective cover.
 3. The visual signal lens housing shall be white with red lettered FIRE or as approved by Architect. The speaker and visual signal shall be mounted to a common white speaker baffle. The visual signal shall flash at a rate of minimum of 1 Hz and maximum of 3 Hz, and shall use a strobe type lamp or other high intensity long life light source. The lamp intensity shall be a minimum of 75 candela.
 4. The speaker shall be UL 1480 compatible with the control equipment. Unit shall operate within a temperature range of 150°F to -30°F. High output speakers, UL minimum 87dB at 10 feet with speaker taps of .33.66/1.25/2.5 watts. Standard output speakers, UL 75-81 dB at 10 feet with speaker taps of .5/1/1.75/2.75 watts. Capacitor for line supervision.
- F. Ceiling mounted recessed mounted speakers (where indicated or required by local AHJ) shall be UL 1480 compatible with the control equipment. Unit shall operate within a temperature range of 150°F to -30°F. UL minimum 78-87 dB at 10 feet with speaker taps of .25, .5/1.0/2.0 watts. Round, white baffle or 2x2 lay-in grid with UL enclosure, tile bridge supports when recessed in lay-in ceiling tiles (where indicated or required by local AHJ) and capacitor for line supervision.
- G. Surface mounted speakers (where indicated or required by local AHJ) shall be UL 1480 compatible with the control equipment. Unit shall operate within a temperature range of 150°F to -30°F UL minimum 100 dB at 15 watts at 10 feet. Speaker taps via 7-position selector switch, 25-vol., .48/.94/1.8/7.5/15 watts. Fully enclosed wiring terminals. Capacitor for line supervision.
- H. Addressable Manual Pull Stations:
1. The manual station shall provide address-setting means using rotary decimal switches. No binary coding shall be required.
 2. Manual stations shall be designed for semi-flush mounting on standard electrical box. The station shall be constructed of hi-impact red molded Lexan with instructions for station operation in raised white letters. Stations shall be of the dual action type.
 3. Install Stopper STI1100 series covers with horns on all manual pull stations, except the one at the FACP and Remote Annunciator.
 4. At renovation: Remove all manual pull stations except one at main fire alarm panel and one at remote annunciator panel, unless otherwise called for by code.
 5. At new construction: Install only two manual pull stations; one at main fire alarm panel and one at remote annunciator panel, unless otherwise called for by code.
 6. Do not specify or use ionization only type detectors unless reviewed and approved by CFISD. Multi-criteria detectors that include ionization detection as one of the criteria to initiate and alarm are acceptable.
- I. Intelligent Multi-Criteria Photoelectric Smoke Detectors
1. The intelligent multi-criteria detection device shall include the ability to combine the signal of the thermal sensor with the signal of the photoelectric signal in an effort to react hastily in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a false alarm condition by examining the characteristics of the thermal and smoke sensing chambers and comparing them to a database of actual fire and deceptive phenomena.
 2. The detectors shall use the photoelectric principal to measure smoke density and

shall, on command from the control panel, send data to the panel representing the ANALOG level of smoke density. The detector shall provide automatic sensitivity "drift" compensation. The detector shall also provide a "maintenance alert" feature whereby the detector shall initiate a trouble condition should the unit's sensitivity approach the outside limits of the normal sensitivity window.

3. The detectors shall provide address setting means electronically and automatically at the control panel.
4. The detectors shall provide operational status and alarm state LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. An output connection shall also be provided in the base for connecting an external remote alarm LED.
5. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist lock base. No radioactive material shall be used.
6. Voltage and RF transient suppression techniques shall be employed as well as smoke signal verification circuit and an insect screen.

J. Intelligent Photoelectric Smoke Detectors

1. The detectors shall use the photoelectric principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the ANALOG level of smoke density. The detector shall provide automatic sensitivity "drift" compensation. The detector shall also provide a "maintenance alert" feature whereby the detector shall initiate a trouble condition should the unit's sensitivity approach the outside limits of the normal sensitivity window.
2. The detectors shall provide address setting means electronically and automatically at the control panel.
3. The detectors shall provide operational status and alarm state LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. An output connection shall also be provided in the base for connecting an external remote alarm LED.
4. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist lock base. No radioactive material shall be used.
5. Voltage and RF transient suppression techniques shall be employed as well as smoke signal verification circuit and an insect screen.

K. Duct photoelectric smoke detectors:

1. Detectors shall be analog addressable type.
2. To minimize nuisance alarms, detectors shall have an insect screen and be designed to ignore invisible airborne particles or smoke densities that are below the factory set alarm point. No radioactive material shall be used.
3. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control panel.
4. Voltage and RF transient suppression techniques shall be employed as well as smoke signal verification circuit and an insect screen.
5. Remote alarm/power LED indicator with test switch shall be provided. Unit shall be wall or ceiling mounted in readily visible and accessible area near the location of detector; exact location of unit to be approved by the Architect/Engineer.
6. Detectors shall operate on the same principles and exhibit the same basic characteristics as area type photoelectric smoke sensors. The detector shall operate in air velocities of 300 FPM to 4,000 FPM. Each detector shall interface directly to the system SLC loop without the requirement of interface zone modules.
7. The unit shall consist of a clear molded plastic enclosure (or remote mounted LED status indicator shall be provided next to the smoke detector) with integral conduit knockouts to provide visual viewing of detector/sensor for monitoring

- sensor operation and chamber condition. The duct housing shall be provided with gasket seals to insure proper seating of the housing to the associated ductwork. Each unit's sampling tubes shall extend the width of the duct and be provided with porosity filters to reduce sensor/chamber contamination.
8. The detectors shall provide alarm and power status indication by LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. Steady illumination of the LED shall indicate that the control panel has detected and verified an alarm condition. An output connection shall also be provided in the base for connecting an external remote alarm LED.
 9. The detectors shall provide address setting means electronically and automatically from the control panel.
- L. Intelligent Thermal Detectors
1. The detectors shall use dual electronic thermostats to measure temperature levels in its chamber and shall, on command from the control panel, send data to the panel representing the analog temperature level.
 2. The detectors shall provide address setting means electronically and automatically at the control panel.
 3. The detectors shall provide operational status and alarm state LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. An output connection shall also be provided in the base for connecting an external remote alarm LED.
 4. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist lock base.
 5. Thermal Detectors shall be combination rate-of-rise and fixed temperature- rated at 135°F for areas where ambient temperatures do not exceed 100°F and shall be 200°F for areas where ambient temperatures exceed 100°F but not 150°F. The fixed temperature element shall consist of a fusible alloy retainer and actuator shaft. Detectors shall have a smooth ceiling rating of 2,500 square feet. Detectors shall be located as shown on the drawings and where required by local code authority.
 6. Provide fixed temperature 190°F detector in kitchen and kiln room in lieu of combination rate-of-rise / fixed-temperature type.
- M. Auxiliary AHU Relays: Air Products model MR-101C relays shall be provided for HVAC and AHU control and interface. Relays shall be heavy-duty type with contacts rated up to 10 amps at 120V AC, 60 HZ. Relays shall be provided with NEMA I dust cover assembly and be provided with DPDT contacts as well as activated LED indicator.
- N. Voltage sensing relays: Addressable control modules for voltage sensing relay interface shall be FCM-1.
- O. Monitor Module:
1. Addressable monitor modules shall be provided where required to interface to contact alarm devices. The monitor module shall be used to connect a supervised zone of conventional initiating devices to an intelligent SLC loop.
 2. The monitor module shall provide address setting means electronically and automatically at the control panel. A status/alarm LED shall be provided which shall indicate that the monitor module is operational and in regular communication with the control panel, and indicate detection of an alarm condition.
- P. Control Module
1. Control/relay modules shall be provided where required to provide audible alarm interface and/or relay control interface. The control module shall be used to connect a supervised zone of conventional indicating devices to an intelligent loop. The zone may be wired class A or class B - field selected. The control

- module may be optionally wired as dry contact (form C) relay.
2. The control module shall provide address setting means electronically and automatically at the control panel. A status/alarm LED shall be provided which shall indicate that the control module is operational and in regular communication with the control panel and indicate when the device is actuated via the fire alarm control panel.
- Q. Auxiliary Interface Points: All auxiliary input points (kitchen hoods, water flow, tamper switches, fire extinguishing systems etc.) shall be connected as required, and addressed as a separate initiating point of annunciation at the fire alarm panel and any remote annunciator as required.
- R. Water flow switches / Valve supervisory switches shall be provided and installed by the fire protection contractor and connected by the fire alarm contractor. Wiring of these field devices to the fire alarm system shall be the responsibility of the fire alarm contractor. It is the responsibility of this contractor to ensure the proper function of the system. Each fire protection zone (flow switch) and (Valve switch) shall be addressed electronically and automatically at the control panel as a separate point of annunciation at the fire alarm panel. Coordinate exact location with fire protection contractor and civil drawings.
- S. Beam detectors:
1. Microprocessor based beam detectors, consisting of a separate transmitter and matching receiver.
 2. Coverage up to 350 ft. X 60 ft.
 3. LED status indicators for normal (green), alarm (red), and trouble (yellow).
 4. The detectors shall provide address setting means electronically and automatically at the control panel.

2.7 MAGNETIC DOOR HOLDERS, AUTOMATIC FIRE DOORS / SHUTTERS, AND SECURITY GRILLES AND INTERIOR SPACE CONTROLLED ACCESS EGRESS DOORS WITH AUTOMATIC EMERGENCY EGRESS ELECTRIC LOCK EMERGENCY RELEASE

- A. Magnetic fire door hold open devices, interface for automatic roll down fire doors/shutters, and interface for security grilles and controlled access egress doors with emergency egress shall be provided. Coordinate with Division 8 and Architectural Drawings for exact location.
- B. The operation of any alarm in the fire alarm system shall cause the following:
1. Release of the magnetic fire door holding devices, permitting the fire doors to be closed by the door closer.
 2. Permit the automatic roll down fire doors/shutters to close automatically.
 3. Permit the security grilles with emergency egress to open automatically.
 4. Unlock the electrically controlled access doors in all interior spaces.
- C. The magnetic door holders, automatic roll down fire doors/shutters, security grilles, and interior electrically controlled access doors with emergency egress, shall be associated with two smoke detectors located on the ceiling with one on either side of the fire door/shutter, security grille opening, or interior egress path electrically controlled door. The operation of either of these detectors shall also cause the magnetic holder to release the fire door, the automatic fire door/shutter to close, and the security grille with emergency egress to open.
- D. The operation of smoke detectors associated with a magnetic door holder, automatic roll down fire door, security grille, or electrically controlled access door shall transmit a pre-alarm signal to the fire alarm panel.

2.8 REMOTE PAGING UNIT

- A. Remote all-call paging unit or to activate one of the pre-recorded messages over the speaker circuits.

2.9 REMOTE ALPHANUMERIC DISPLAY ANNUNCIATORS

- A. (Where indicated or required by Local Authority Having Jurisdiction) Remote alpha-numeric annunciator(s) to annunciate all system events and duplicate the displayed status at the main FACP. The annunciator(s) shall be an 80-character display similar to the main FACP and operate via the system RS485 or RS232 serial output terminal from the main FACP. The unit shall operate from FACP 24VDC power and function during system power failure while the system resides on standby batteries. The remote annunciator(s) shall include:
1. Integral time/date clock
 2. System reset
 3. System silence
 4. System acknowledge
 5. Display/step switch
 6. Integral trouble buzzer
 7. LCD contrast adjust
 8. Fire Drill Operation
 9. Owner's list of additional remote annunciator control buttons.
- B. Annunciator shall upon command display the first system alarm, last alarm, and system alarm count. The following primary controls shall be visible through a front access panel:
1. 80 character alphanumeric display, LCD, LED, or gas plasma
 2. Individual red system alarm LED
 3. Individual yellow supervisory service LED
 4. Individual yellow trouble LED
 5. Green "POWER ON" LED
 6. Alarm acknowledge key
 7. Trouble acknowledge key
 8. Alarm silence key
 9. System reset key
 10. LED test
 11. Additional control buttons as directed by Owner.

2.10 AUXILIARY EQUIPMENT MONITORING

- A. The fire alarm system shall monitor for alarm, supervisory, and trouble conditions; and annunciate the status of the following equipment when provided, or is existing to remain, as part of this project. A failed status shall activate the trouble alarm.
1. Emergency Generator: Run Status
 2. Emergency Generator: Trouble Signal
 3. Fire Pump: Run Status
 4. Fire Pump: Trouble Signal
 5. Emergency Service Communications Systems, as required by NFPA 72 and NFPA 1221.

2.11 WIRING

- A. All fire alarm wiring outer jacket color shall be red. All wiring shall be in accordance with NFPA 72, the National Electrical Code (NEC 760), and Local Codes.,. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.
- B. All fire alarm system cable shall be U.L. Listed FPLP or MPP plenum rated for limited energy, 300V insulation rating, and listed for fire alarm applications and shall be installed in conduit. Plenum rated fire alarm system cable may be run open without conduit above

accessible lay-in ceilings and in return air accessible ceiling plenums, and shall be supported above lay-in accessible ceilings from approved hangers, provided such wire is U.L. Listed for such applications and is of the low smoke producing fluorocarbon type and complies with NEC Article 760 if so approved by the local authority having jurisdiction. Fire alarm cabling shall be installed in conduit in any area so that the exposed cabling is not be visible from public view.

- C. No other wiring shall be run in the same conduit as fire alarm wiring.
- D. Minimum wire sizes shall be as follows:
 - 1. Initiating Circuits: 18 AWG
 - 2. Strobe Circuits: 14 AWG
 - 3. Relay Control Circuits: 18 AWG
 - 4. Voice/Speaker Circuits: 16 AWG
- E. All wiring and pathways shall be run parallel or perpendicular to building walls.

PART 3 - EXECUTION

3.1 EXPANSION OF EXISTING SYSTEM

- A. Testing of existing systems:
 - 1. Provide complete operational test of existing fire alarm system prior to any demolition or construction. Verify operation of each device, control panel, distribution equipment and associated accessories.
 - 2. Provide a complete written report to the Architect, indicating any deficiencies of the existing system in relation to each component's intended function. In addition, provide deficiencies of the existing system with regard to current Code, ADA, and Local Accessibility Standards requirements. Provide the written report 14 days prior to any work related to the expansion of the existing system.
 - 3. Testing of the existing system shall include all areas and all buildings served by the existing system.
- B. Expand the existing system in all expansion or renovation areas to include requirement specified and as required by the local authority having jurisdiction. Verify compatibility of new equipment with existing system.
- C. Provide smoke detectors in the following locations in addition or renovated areas:
 - 1. All paths of egress and adjoining spaces within the same envelope including but not limited to: corridors, hallways, stairs, lobbies, and elevator landings.
 - 2. At each electrical room, telecommunications/data room, elevator machine room, kiln room, and mechanical room not subject to un-treated or un-filtered outside air.
 - 3. At each computer lab/room.
 - 4. At each library or book storage room.
 - 5. At each storage room, stock room, or warehouse space.
 - 6. At each pre-K and kindergarten classrooms.
 - 7. At nurse's area/clinic and patient care/cot areas.
 - 8. At each special needs, life skills, adaptive behavior, developmental classrooms or similar designated areas without food preparation or cooking equipment.
 - 9. At each student toilet/restroom. Provide STI protective covers. Do not locate over plumbing fixtures or near partitions.
- D. Provide heat/thermal detectors in the following locations in addition or renovated areas:
 - 1. At each mechanical room subject to un-treated or un-filtered outside air.
 - 2. At each janitor's closets and laundry rooms.
 - 3. At each commercial kitchen and adjoining storage rooms; at each food preparation area.

4. At each employee break room.
 5. At each vocational shop.
 6. At each science, physics, chemistry, or biology classroom and their associated preparation and storage rooms.
 7. At each special needs, life skills, adaptive behavior, developmental classrooms or similar designated areas with food preparation or cooking equipment.
- E. Provide carbon monoxide detection and smoke detection devices in all areas designated as day-care for minors.
- F. Provide duct smoke detectors in all air handling units with air volumes of 2,000 cfm or larger.
1. Where duct smoke detectors are installed above ceilings, provide external remote status/alarm LED mounted flush with ceiling in close proximity to the duct detector location. If space is open without ceiling, wall mount remote status/alarm LED in close proximity to the detector between 96 and 108-inches AFF, or as directed by Owner.
- G. Provide duct smoke detectors on outside air units only as required by local Code and / or AHJ.
- H. Provide VESDA type detectors at the following locations when appropriate:
1. Atriums to avoid exposed conduits.
 2. High ceiling areas 25 feet and higher where maintenance of spot type detectors will be difficult.
 3. Skylights to avoid exposed conduits.
 4. Coolers/Freezers 200 square feet and larger.
- J. Provide weatherproof exterior audio/visual alarm devices mounted on the building at the exact location as directed by Architect:
1. Main entry.
 2. Courtyards and outdoor assembly areas adjacent to the building.
 3. Mechanical yards adjacent to the building.
 4. Covered playgrounds or covered assembly areas adjacent to the building.
 5. Additional locations where indicated on drawings.
 6. Outdoor paved play areas.
- K. Provide audio and visual alarm devices in all areas normally occupied by students or minors and all common use areas.
- L. Provide beam type detectors at the following locations when appropriate:
1. Atriums.
 2. High ceiling corridors where maintenance of spot type detectors may be difficult.
 3. Areas with skylights.
- M. Provide audio and visual alarm devices in all areas normally occupied by students or minors. The renovated and expansion areas' smoke control envelope audio alarm shall be equipped with voice alarm capability regardless of local AHJ requirements. Existing areas shall remain temporal audio alarm only.
- N. Provide carbon monoxide detection and smoke detection devices in all areas designated as day-care for minors.
- O. Provide carbon monoxide detection in classrooms and other instructional spaces served by a fuel-burning appliance, fuel-burning HVAC equipment (including roof mounted equipment), or with gas fuel outlets for connection to portable fuel-burning space heaters and appliances such as Bunsen burners which are typically used in laboratories or science classrooms.

3.2 GENERAL REQUIREMENTS

- A. Installation shall include the delivery, storage, setting in place, fastening to the building structure, interconnection of the system components, alignment, adjustment and all other

- work, whether or not expressly specified, which is necessary to result in a tested and operational system.
- B. All installation practices shall be in accordance with, but not limited to, the specifications and drawings. Installation shall be performed in accordance with the applicable standards, requirements and recommendations of NFPA 72 and the National Electrical Code and any authorities having jurisdiction. Proper protection against corrosion shall be provided on all electrical equipment in accordance with the requirements of the National Electrical Code. The installation shall conform to all manufacturers' recommendations.
 - C. All equipment shall be firmly secured in place unless requirements of portability dictate otherwise. Fastenings and support shall be adequate to support their loads with a safety factor of at least three.
 - D. All boxes, equipment, etc., shall be plumb and square. The contractor must take such precautions as are necessary to prevent and guard against electrostatic hum, to supply adequate ventilation, and to install the equipment to provide reasonable safety for the operator.
 - E. Visual displays, GUIs, or other indicators for main fire alarm panel and all remote annunciators shall be at maximum 66 inches AFF.
 - F. All remote booster and associated equipment panels shall be mounted with top of enclosure maximum 66 inches AFF.
 - G. In the installation of equipment and cables, coordinate with Architectural drawings for possible conflicts with millwork, casework, marker boards, furniture, lockers, etc., and notify the architect of any discrepancies. Verify modifications before proceeding with installation.
 - H. Mount end-of-line resistor for each box circuit in backbox located at the last manual alarm station or automatic initiating device in a circuit. Mark device accordingly in the field.
 - I. Provide three dedicated Cat 6 cables from MDF/IDF to fire alarm panel. Cable shall be installed in 3/4" conduit. Two cables for phone POT lines and one Ethernet data connection.
 - J. Upright and/or Wall Post-Indicating Valve: Provide conduit and wiring from fire alarm control panel to post-indicating valve if electronically supervised, coordinate exact location of PIV with fire sprinkler contractor prior to rough-in. Coordinate final location with Civil Drawings and Fire Protection Contractor. Where equipment is located inside a vault, stub required conduit inside vault, turn up and cap.
 - K. Contractor shall submit on completion of system verification, a point-by-point check list indicating the date and time of each item inspected and issue a certificate confirming that the inspection has been completed and the system is installed and functioning in accordance with the Specifications prior to date of substantial completion.
 - L. Provide remote alphanumeric display annunciators in the administrative area in constantly attended area, as required by the Local AHJ, and additional annunciators where indicated on the drawings, as directed by Owner / Architect.
 - M. Alarm devices shall be ceiling mounted unless indicated specifically otherwise. Alarm devices in Mechanical, Electrical, Communications, IDF / MDF Rooms and Central Plant shall be wall mounted and coordinated with other equipment, piping and ductwork.
 - N. Provide combination speaker strobes. Provide strobe only alarms when additional speaker placement will compromise voice intelligibility. Provide horn/strobes in coolers and freezers.
 - O. Detectors shall be installed per NFPA 90A and be listed with the fire alarm control panel.
 - P. Auxiliary Equipment Monitoring Wiring and connection to equipment shall be the responsibility of the fire alarm contractor.
 - Q. Power for magnetic door holders shall be provided from the nearest receptacle circuit wired through fire alarm relay.
 - R. Smoke detectors shall be mounted to a 4-inch octagon box with hanger bar or with box

- secured to building structure.
- S. Provide power via 120-volt, 20-Amp dedicated circuits with lock-on provisions at the respective circuit breaker for each new main fire alarm control panel, each new panel extender and each new remote power supply at no additional cost to the Owner. The complete fire alarm system shall be powered under emergency power when emergency life safety power is available at the project site. When emergency life safety power is not available at the project site, power shall originate from the nearest available 120-volt panel, or as indicated.

3.3 CABLE AND BOXES INSTALLATION

- A. All circuits shall be protected to avoid interruption of service due to short-circuiting or other conditions, which might adversely affect the connected devices. Each individual signaling circuit shall be classified as a circuit pair.
- B. All cabling in racks, cabinets and junction boxes shall be neatly strapped, dressed and adequately supported. Cable installation shall conform to good engineering practices and to the standards of the National Electrical Code.
- C. Cables shall be terminated with the proper connector required for the associated operation of the equipment to which it is connected. Screw terminal blocks shall be furnished for all cables, which interface with racks, cabinets, consoles or equipment modules.
- D. All cables within a rack, console or junction box shall be grouped according to the signals being carried to reduce signal contamination.
- E. Where shielded conductors enter a panel or enclosure, and where power wiring exists, provision shall be made to provide physical isolation of signal and power conductors.
- F. Supply and install all fittings and accessories whether or not they are specified, required for proper, safe and reliable operation of the system.
- G. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit fill shall not exceed 40%.
- H. Minimum conduit size shall be 3/4" EMT with insulated bushings. Install conduit per engineered shop drawings.
- I. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed to view and or subject to damage.
- J. All vertical wiring and all main trunk/riser wiring shall be installed in a complete raceway/conduit system. All riser boxes shall be adequately sized for the number of conductors transversing the respective box as well as the number of terminations required.
- K. All junction boxes containing fire alarm wiring are to be painted red.
- L. All plenum wiring is to be installed parallel and perpendicular to the building structure. Cable shall be bundled with cable ties on a maximum of 2'-6". Install cables in D-ring hangers secured to the structure at a maximum of 5' on center. Cable shall not lie on ceiling grid or ceiling tiles, light fixtures, piping, ductwork or foreign equipment.
- M. The system ground is to be connected to the local ground bus. Under no conditions shall the AC neutral either in a power panel or in receptacle outlets be used for a reference ground.
- N. All wiring shall be in accordance with NFPA 72, the National Electrical Code, and Local Codes. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.
- O. All wire shall be UL Listed FPL for limited energy (300V) and fire alarm applications and shall be installed in conduit. Limited energy FPLP or MPP wire may be run open in return air ceiling plenums provided such wire is UL Listed for such applications and is of the low

- smoke producing fluorocarbon type and complies with NEC Article 760 and approved by the local authority having jurisdiction.
- P. No other wiring shall be run in the same conduit as fire alarm wiring.
 - Q. All fire alarm wiring to be red. All fire alarm circuits shall be identified at each termination and at each 25 feet between terminations.
 - R. Copper wiring leaving or entering main building shall be protected on both ends with surge suppression; otherwise use fiber-optic cabling.

3.4 ALARM SYSTEM SEQUENCE OF OPERATION

- A. General:
 - 1. All fire alarm circuits shall be electrically supervised.
 - 2. Automatic response functions shall be accomplished by the first device initiated. Alarm functions resulting from initiation by the first device shall not be altered by subsequent alarms. An alarm signal shall be the highest priority. A pre-alarm signal shall have second priority and supervisory or trouble signals shall have third and fourth level priority. Signals of a higher level priority shall take precedence over signals of lower priority even though the lower priority condition occurred first.
- B. Fire alarm operating sequences shall be as follows:
 - 1. Activation of any automatic detector, manual station, fire suppression system, sprinkler flow switch or any other system required by NFPA 72 to be monitored to initiate an alarm condition shall cause the location of the alarm to be identified in an audible and visual manner at the building fire alarm control panel (FACP), and shall initiate the following events:
 - a. The system common alarm LED on the CPU Module shall flash. The internal audible trouble device shall sound. Acknowledging the alarm condition shall silence the audible trouble device and revert the flashing common alarm LED to a steady state.
 - b. The 80-character display shall indicate all applicable information associated with the alarm condition including: zone, device type, device location based on actual room graphic name and number (not architectural plan names and numbers), and time of alarm. Location and zoning messages shall be custom field programmed to respective premises.
 - c. Any remote or local annunciator LED's associated with the alarm point shall be illuminated as herein specified.
 - d. The remote signaling connection shall be activated relaying the alarm signal to an approved central station (central station connection and service provided by Owner). Point ID and descriptor must be sent and received.
 - e. All automatic events programmed to the alarm point shall be executed and the associated indicating devices and/or outputs activated.
 - f. De-activate local sound reinforcement systems that are not UL listed nor integrated with the fire alarm system control panel for providing fire alarm or mass notification instructions. Building wide public address systems shall remain active only for manual mass notification. Public address system auxiliary audio inputs used for background music or other remote non-emergency audio sources shall be silenced to only allow priority level manual mass notification using the public address system.
 - g. Activate all audible/visual alarm devices. Where prerecorded voice announcement is required or specified, the prerecorded announcement shall be preceded with attention tone(s), followed by the approved prerecorded announcement and continue in a cycle until the system is

- reset. Manual voice announcement shall interrupt the prerecorded cycle and the prerecorded cycle shall resume automatically after three minutes.
- h. De-activate all HVAC systems including low speed high volume (LSHV) circulating blade type fans.
 - i. De-energize the kitchen hood supply/exhaust fans as required by local authority having jurisdiction.
 - j. Close all related smoke dampers.
 - k. Close all related smoke/fire dampers.
 - l. Release all magnetic door hold open devices.
 - m. Release the electric strike, unlocking, but not unlatching, locked doors controlled by an access control system.
 - n. Release Counter Shutters and hold-open devices on all fire and smoke doors.
 - o. Open all security grilles with emergency egress.
 - p. Activate to close all related fire and smoke doors and shutters.
 - q. Activate signaling connection to the elevator as required by the local authority having jurisdiction.
 - r. Signal the building automation system and Owner's security / police personnel as directed by Owner / Architect. The audible alarms shall be inhibited from being silenced for a period of 3 minutes after commencing operation unless alarm is acknowledged, and appropriate action has been taken.
 - s. Activate automatic recall operation of elevators as required by local authority having jurisdiction.
 - t. Record all events on the system printer.
2. Activation of duct mounted smoke detector on the HVAC equipment, or a smoke detector mounted in the return/supply air stream of any fan shall shut down all units as required by NFPA. The activation of one of these detectors shall initiate the Alarm Sequence of Operation.
3. Activation of a control valve supervisory switch shall initiate the following events:
- a. The activation of any sprinkler valve supervisory (tamper) switch shall activate the system supervisory service audible signal and illuminate the LED at the building fire alarm control panel (FACP). Differentiation between valve tamper activation and opens and/or grounds on the initiation circuit wiring shall be provided.
 - b. Activation of a sprinkler system control valve supervisory switch shall not prevent the events listed under Article 3.4.
 - c. Restoring the valve to the normal position shall cause the supervisory service audible signal to pulse, indicating the restoration to normal position. The supervisory service reset key shall be provided to silence the audible signal.
4. Activation of the smoke detector and heat detector in the elevator machine room and at top of elevator shaft shall cause the elevators' controllers to be tripped by way of the shut trip breaker, and shall also initiate the events listed under Article 3.4.
5. Any subsequent fire alarm shall reactivate the alarm indicating appliances and activate the respective control sequences described above.
6. Upon silencing the alarm, all visible alarm devices shall remain active until system reset, and all local sound reinforcement systems de-activated by the fire alarm system shall resume normal operation.
7. Upon reset of the fire alarm control panel, HVAC units shall be capable of being started, and resume normal operation.

- C. Activation of the manual evacuation pull (drill) switch shall operate the alarm indicating appliances and de-activate local sound reinforcement system without causing other control circuits to be activated. However, should true alarm occur, all alarm functions should occur as described.
- D. ALARM VERIFICATION shall be field programmed for each respective detector. Global verification will not be acceptable. The verification sequence is activated after a "check" procedure and the panel will wait a field programmable delay period (0-50 seconds) then proceed to re-sample the detector for continued presence of smoke. If the alarm condition still exists or a non-verified device is actuated during the verification period, the system will then initiate all alarm sequences specified herein. The system shall incorporate the ability to log in memory the number of verification events that have occurred for each selected device.

3.5 EQUIPMENT IDENTIFICATION

- A. Each new panel or equipment enclosure shall be provided with a permanently engraved or embossed or silkscreen identification tag. The tag shall include the following information:
 - 1. Name of manufacturer.
 - 2. Manufacturer's equipment description.
 - 3. Serial number and model number.
 - 4. Voltage and current rating.

3.6 SPARE PARTS AND TOOLS

- A. Interchangeable Parts: All spare parts furnished shall be directly interchangeable with the corresponding components of the installed system. Spare parts shall be packaged and identified by nameplate, tagging, or stamping. Spare parts shall be delivered to the site in unopened cartons for storage as directed by the Owner.
- B. Spare Parts: Provide minimum of one, or 5% of renovation area total, whichever is greater unless noted otherwise.
 - 1. Spare shut down modules
 - 2. Spare detectors of each type in the system
 - 3. Spare alarm indicating devices of each type in the system
 - 4. Spare manual pull stations
 - 5. Spare protective covers of each type in the system.
 - 6. Spare relays/controls required for connection to smoke and fire/smoke dampers
 - 7. Devices listed above are to be installed as directed by Architect/Engineer or local code authorities at no additional cost to the Owner. Unused spare parts are to be parts for Owner's cabinet.
- C. Provide one smoke, heat and carbon monoxide detector testing kit. SDfire #TF2823 with Solo Testfire #2001 tester with 15-foot access pole and three 4-foot pole extensions, detector removal tool, and carrying bag.
- D. Provide two copies of the final software programmed into the fire alarm system.
- E. Parts list: Furnish a list, in duplicate, of all other parts and accessories the manufacturer of the system recommends to be stocked for maintenance.

3.7 KEYS

- A. Keys and locks for all equipment shall be identical to the existing building master key for the fire alarm system.

3.8 SMOKE DAMPERS AND FIRE/SMOKE DAMPERS

- A. Smoke dampers and combination fire/smoke dampers shall be controlled by an automatic alarm initiating device. Smoke dampers installed to isolate the air handling system shall be arranged to close automatically when the system is in alarm.

- B. Coordinate motor operator voltage with supplier.
- C. Open all dampers prior to starting air handling equipment.
- D. Provide 120V power from nearest general purpose 20A receptacle circuit as required, or as noted otherwise.

3.9 GRAPHIC FLOOR PLANS FOR AHJ SITE PERMITTING INSPECTION AND OWNER USE

- A. It is the intent of these specifications that the fire alarm system shall pass AHJ inspection on the first try. The fire alarm system shall be fully functional, commissioned, and mapped both on fire alarm graphic maps and fire alarm annunciator device descriptions to fully and correctly described the device type and detailed location. Provide color coded floor plans detailed with actual room names, actual graphic room numbers as directed by the Owner and adequate information to direct people to the fire alarm devices in alarm and to exits with non-fading floor plan media. Do not use architectural plan room names and numbers. Fire alarm maps shall include all relevant building information and fire alarm device information as required for the local AHJ permitting site walk-through inspection.
- B. Each plan shall clearly relate the room numbers on the annunciator to the area description on the floor plan. All fire alarm devices located to correspond with the annunciator.
- C. Provide two color coded floor plans for Owner use that shall be solvent welded in acrylic plastic.
 - 1. Mount in an extruded aluminum frame next to the main fire alarm control panel.
- D. Install graphic floor plans as directed by Architect/Owner prior to substantial completion. Each area or room designation shall be verified with the fire alarm device during testing.

3.10 ADDITIONAL REQUIREMENTS

- A. Coordinate with Owner for appropriate off-site monitoring service and communication technology to be used. Provide all necessary programming for interfacing with the Owner's on-site and off-site remote signaling receiving station, including programming of descriptors and addresses at the receiving station.
- B. The contractor is to ensure all areas of the renovation and new construction are covered with visual and audio alarm devices for occupant notification of a fire alarm including remote portable or temporary buildings.
- C. Coordinate door hold devices with door and door hardware.
- D. Provide interface with and coordinate shunt-trip circuit breakers and control devices with kitchen hood fire control systems (where new kitchen hood fire control systems are provided) and elevator equipment (where new elevators are provided).
- E. Alarm circuit power supplies and circuiting shall be designed and installed to accept an additional five (2) 110cd visual devices for future expansion. The initial design shall not exceed 70% of the rated power supply and circuit capability with the two additional 110cd devices installed.
- F. Provide programming or re-programming of all hot keys as directed by Owner including, but not limited to, fire drill, AHU shutdown bypass, horn/strobe disable, elevator test.

3.11 COMMISSIONING THE SYSTEM

- A. The installing contractor shall be responsible for verifying that each new or relocated component of the system is fully operational and in conformity with the specifications. He shall also be responsible for insuring that all elements function together as a system in accordance with the specifications.
- B. A state licensed and factory trained technical representative of the manufacturer with NICET Level 3 minimum certification shall supervise the final control panel connections and testing of the system. Upon completion of the acceptance tests, the owner and/or his

representatives shall be instructed in the proper operation of the system.

- C. The installing contractor shall functionally test each and every device in the entire system for proper operation and response. Any new or relocated items located within the construction or renovation area found not properly installed or non-functioning shall be replaced or repaired and retested. The final test indicating a fully functional fire alarm system shall be recorded; electronic Excel and printed copy submitted to the Architect, Engineer and Owner.
- D. The installing contractor shall provide a complete written report and printout of the functional test of the entire system after all existing deficiencies of the existing system have been corrected by the Owner, or as directed by the Owner. The test report shall be signed and dated by the licensed fire alarm superintendent responsible for supervising the final system test and checkout. This test shall be completed and accepted by the Owner prior to testing for the local Fire Marshall.
- E. The installing contractor's fire alarm superintendent shall test the entire system in the presence of the local authorities having jurisdiction. The contractor shall be responsible for making any changes, adjustments, or corrections, as may be required by the local authorities. The Contractor shall affix his certification label and installation certificate to the interior of the main fire alarm control panel.
- F. The testing and acceptance shall be performed within 30 days after the fire alarm installation is completed. The test shall be performed by a minimum of two qualified fire alarm system technicians acceptable to the authority having jurisdiction. The test which is a comprehensive 100 percent inspection and test of all fire alarm system equipment shall include the following:
 - 1. Fire alarm control equipment: a visual and functional test of the fire alarm control and auxiliary control equipment.
 - 2. A visual inspection shall be conducted to establish that all electrical connections and equipment, as required, are properly installed and operating.
 - 3. A functional fault simulation test shall be conducted on all relevant field wiring terminations to ensure that wiring is properly supervised as required.
 - 4. Indicators shall be tested to ensure proper function and operation.
 - 5. Control panel auxiliary functions shall be functionally tested to verify proper operation.
 - 6. Control panel supervisory and alarm current readings shall be taken to verify that the control panel has the appropriate power supplies and standby batteries to operate the system as required. A three-minute general alarm stress test, both under AC power and standby power, shall be conducted to further ensure complete operation of the system.
 - 7. Fire alarm peripheral devices; All fire alarm peripheral devices shall be functionally tested and the location and testing information recorded for each device.
 - 8. Manual initiating devices:
 - a. Each manual fire alarm station shall be functionally tested for alarm operation.
 - b. Each manual fire alarm station shall be functionally tested for proper wiring supervision.
 - 9. Automatic initiating devices:
 - a. Each automatic initiating device shall be activated in accordance with manufacturer's instructions to ensure proper operation.
 - b. Each automatic initiating device shall be functionally tested for proper wiring supervision.
 - c. Each automatic initiating device shall be inspected to ensure proper placement and mounting as required by specifications.

10. Alarm signaling devices:
 - a. Each alarm signaling device shall be tested and decibel reading taken at 10' from the device and recorded to ensure proper operation. Each area's voice alarm signaling devices shall be tested for intelligibility.
 - b. Each alarm signaling device shall be functionally tested for proper wiring supervision.
 - c. Decibel reading shall be taken to ensure that the alarm signal level can be clearly heard in all areas of the facility.
 - d. All visual alarm indicators shall be functionally tested to ensure proper operation and that they are clearly visible.
11. Elevators: Each elevator shall be tested and automatic recall function verified.
12. Reporting: Upon completion of the initial verification audit, a report shall be sent to the Architect/Engineer indicating that all fire alarm equipment has been tested and is in 100 percent operation. The report shall also contain the audit testing information as to the location and operational status of each peripheral device. The 100 percent audit shall be performed by a factory-trained representative. The report shall include the voice intelligibility performance in each area and indicate compliance with NFPA and local AHJ requirements.
- G. It is the intent of these specifications and of the Architect/Engineer that a continued program of system maintenance will be provided by the Owner in compliance with NFPA 72. It is mandatory that the installing Contractor provide such services and make available these services to the Owner upon completion of the project.
- H. Upon completion of installation and full acceptance testing, submit NFPA 72 certificate of compliance that the total fire alarm system, including any subsystems, is fully functional and that the components are UL listed for function intended.

3.12 SUBSTANTIAL COMPLETION

- A. Final acceptance of the FIRE ALARM SYSTEM by the owner, local code authorities and Occupancy Permit has been issued.
- B. All fire alarm system shop drawings, operating and maintenance manuals, maps and as-built drawings shall be submitted to and accepted by the Architect / Owner prior to date of substantial completion.

END OF SECTION

SECTION 28 5500
RF SURVEY FOR IN-BUILDING EMERGENCY RESPONDER RADIO COVERAGE (ERRC)
AND
TESTING OF EXISTING ERRC ENHANCEMENT SYSTEMS (ERRCES)

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The purpose of this specification is to establish the requirements and standards for surveys for public safety radio signal strength in buildings as required by the NFPA, IBC, IFC and local AHJ. This specification is only for a RF survey. If an existing ERRCES is on premise and is operational, provide verification and documentation of the existing ERRCES as specified.
 - 1. This survey is required as part of the contract documents and shall be implemented as specified in this specification unless indicated or specified otherwise.
 - 2. This survey is required for in all buildings with basements, all buildings four stories and taller, and all buildings with an aggregate total building area of 50,000 square feet or more; this survey may still be required for other buildings that do not meet these structural requirements.
 - 3. This survey may not be required if the local AHJ has pre-determined that an Emergency Responder Radio Coverage Enhancement System (ERRCES) is not required for the subject building(s). If a survey is not required by the AHJ, notify the Architect, Engineer, Owner prior to scheduling the survey.
 - 4. The survey requirements specified in this section are intended to be slightly more stringent than minimum IBC and IFC requirements. This is to help mitigate radio coverage deficiencies that could be caused by future minor variations in building use configurations and changing atmospheric conditions.
- B. Where the subject building(s) do not have an existing ERRCES, this survey shall be for ERRC measurements and compliance evaluation only, it is not intended as a requirement for designing nor a requirement for providing an ERRCES.
- C. Where the subject building(s) have an existing and operational ERRCES, this survey shall include a full yearly functionality test of the existing ERRCES hardware, antennae, wave guides, cabling, wiring, and connectivity as required by the local AHJ, IBC, IFC, and NFPA. This survey shall then be able to be used for the required yearly inspection and testing report of the existing ERRCES. If deficiencies of an existing ERRCES are observed or detected during field signal measurement, the contractor shall document those deficiencies and report them to the Owner in writing within two Owner's business days of completion of the testing so that the Owner can take immediate remedial action. Corrections and modifications to existing ERRCES are not part of this specification section requirements.
- D. Technical information for this survey shall be obtained from the local AHJs pertaining the specific technical information and requirements for the emergency responder communications coverage system. This information shall include but not be limited to the various frequencies required, the location of radio antennae sites, the effective radiated power of the AHJ radio antennae sites, the maximum propagation delay in microseconds, the applications being used, and other supporting technical information that would be necessary for an ERRCES design and to fully test an existing ERRCES.
- E. Surveys for new construction shall be performed after the building is fully dried in, with interior wall construction and all exterior wall glazing completed, and prior to start of installation of electrical wiring. It is the intent that this survey be completed as soon as practical, results reported to the Owner and analyzed, and if required or specified as part of the contract documents or if it is to be provided by others, a radio antenna/repeater system can be designed, installed, fully operational, and commissioned without delaying

- the scheduled contract date for certificate of occupancy (CO) or the AHJs final inspection and approval for full Owner and public occupation of the building.
- F. Conduct surveys using a RF Spectrum Analyzer, a calibrated system-compatible radio or another suitable instrument with traceable certificate of calibration to analyze the RF signal strength of Emergency Responder Radio Signal into the building and determine if amplification of the signal is required or that if existing, the existing ERRCES is functioning properly and providing the proper radio coverage. All test equipment shall have been calibrated within the previous 12-months of the date(s) of testing. Both inbound and outbound signal strength shall be determined, measured, calculated, and documented as required by code. General weather conditions and time of day during the test shall be documented as part of the survey report.

1.2 SURVEY CRITERIA

- A. The required Public Safety Radio Signal Level inside the Owner's facility shall be as required by code, ordinance, AHJ, and as specified.
- B. Survey shall be performed by an FCC licensed technician holding a current General Radiotelephone Operator License (GROL). Where required by the local AHJ, the licensed operator shall be registered with the AHJ as an ERRC Special Inspector (or equivalent designation given by the AHJ) with in-building emergency radio system certification issued by a nationally recognized organization, school, or the emergency radio system manufacturer of the equipment being tested where an existing ERRCES is being tested, or certification by the ERRCES if a new ERRCES is specified elsewhere to be installed as part of the contract documents.

1.3 REGULATIONS

- A. Codes, regulations, and standards shall be the latest published standards. The latest national published standards listed below shall supersede any local standard unless doing so would violate the intent of the local code requirements.
1. NFPA 1 – Fire Code
 2. NFPA 70 – National Electrical Code
 3. IFC 510- Emergency Responder Radio Coverage
 4. NFPA 101, Life Safety Code, and all local amendments and requirements.
 5. NFPA 72 National Fire Alarm and Signaling Code
 6. FCC 47 CFR Telecommunications
 7. FCC 47 CFR 90.219 Use of Signal Boosters
 8. IFC - International Fire Code
 9. Local or State Fire Codes
 10. ADA "Americans with Disabilities Act" and any local or state or local accessibility standards and amendments.
 11. FCC's OET 65 Standards "Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields"
 12. FCC Rules Part 22 Public Mobile Services, Part 90 and Part 101
 13. NFPA 1221- Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems
 14. IBC - International Building Code
 15. UL 2524 - Standard for In-building 2-Way Emergency Radio Communication Enhancement Systems
 16. NFPA 3000 (PS) - Standard for an Active Shooter/Hostile Event Response (ASHER) Program and if present, Owner's specific ASHER Program. Note: Although currently considered by the NFPA as a Provisional Standard (PS), the issued NFPA 3000 shall be considered part of this specifications as if it were a fully accredited document to NFPA standards. If the building Owner has established an ASHER Program, it too shall be considered part of this specification section requirements.

1.4 DEFINITIONS

A. Definitions:

1. Area: A enclosed space in a building consisting floor to ceiling walls with doors.
2. ASHER Program: Active Shooter Hostile Event Response Program. Program elements developed by the building's Owner to determine the necessary functions and actions related to preparedness, response, and recovery from an active shooter/hostile event response.
3. BDA: Bi-Directional Amplifier. A device used to amplify band-selective or multi-band RF signals in the uplink, to the base station and in the downlink from the base station to subscriber devices for enhanced signals and improved coverage.
4. BER: Bit Error Rate is the number of bit errors per unit time
5. DAS: Distributed Antenna System
6. ERRCES / ERRCS: Emergency Responder Radio Coverage Enhancement System / Emergency Responder Radio Coverage System. A two-way radio communication system installed to assure the effective operation of radio communications systems for fire, emergency medical services, or law enforcement agencies within a building or structure. A system used by firefighters, police, and other emergency services personnel.
7. FCC: Federal Communications Commission
8. Grid or test grid: The individual specified and/or code required imaginary spaces inside the building used for radio coverage testing. Typically a grid space consist of a square space with equal or almost equal side dimensions where the radio signal levels are measured at the center of each grid space to verify radio coverage. Grid spaces can consist of individual areas or rooms meeting the maximum size requirements.
9. GROL- FCC General Radiotelephone Operators License
10. OET 65 Standards: FCC's Bulletin 65 provides Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.
11. Public Safety/First Responder: Public Safety or First Responder agencies that are charged with the responsibility of responding to emergency situations. These include, but are not limited to law enforcement departments, fire departments, and emergency medical companies. Typically, there may be multiple agencies for each type of responder, including those administered by the building Owner.
12. RSSI: Received signal strength indicator RSSI is a relative measurement of the power present in a received radio signal.
13. Zone: The individual partitioned grid specified and/or code required imaginary space(s) inside large buildings. Typically, each zone shall be no more than 50,000 square feet and shall be contiguous on the same building floor. Zones are further sub-divided into smaller grid spaces so that radio signal levels can be measured at the center of each grid space to verify radio coverage. A zone can be an individual wing of a building or separate floors of a building that do not exceed 50,000 square feet each. Zones can be created for separate test report areas to ensure individual grid test spaces are not excessive in physical area size and detrimental to the accuracy and resolution of the test data measurement point locations. Each zone must pass the radio coverage test for the entire building to pass the test. Zones can exceed 50,000 square feet as long as the maximum allowable grid space size is not exceeded.

PART 3 – EXECUTION

3.1 EXECUTION

- #### A. Testing Procedures and Parameters

1. The test shall be conducted using a calibrated portable radio authorized by the local AHJ, and of the latest brand and model used by the agency talking through the agency's radio communication system.
2. Testing shall include all critical areas required by the NFPA 1221 and others included in the list below. Critical areas shall be provided with a minimum 99-percent floor area radio coverage in each specific area. Critical areas include but are not limited to the following areas:
 - a. Fire command centers
 - b. Fire pump rooms
 - c. Exit stairs
 - d. Exit passageways
 - e. Elevator lobbies
 - f. Areas of rescue or refuge
 - g. Areas with or spaces adjacent to standpipe cabinets
 - h. Areas with or spaces adjacent to sprinkler sectional valve locations
 - i. Areas with or spaces adjacent to bleeding control kits.
 - j. Areas with or spaces adjacent to Automatic External Defibrillators (AEDs) for public use.
 - k. Areas designated for persons with special needs or areas for specifically designated for persons who are not ambulatory including those in wheelchairs but require physical assistance by others to evacuate the building.
 - l. Specific bullet resistant areas or spaces designated by the Owner or designated in the Owner's ASHER Program as a bullet resistant panic and safe room/areas or spaces.
 - m. Front lobby areas and/or building administrative areas with direct wired microphone or wired telephone handset access to the building's mass notification or building wide communication system when such system is existing or to be installed as part of this project.
 - n. Areas and/or building administrative areas with public safety radio base stations used for direct communications with Owner's police or security personnel.
 - o. Other areas deemed critical by the AHJ.
3. Testing grid spaces, areas, and zones shall be as required by the local AHJ and/or as specified in this specification. The more stringent requirements of the local code, AHJ, or those specified or indicated elsewhere in the contract documents shall apply. Specific requirement for the test grids, areas, and zones shall be follows:
 - a. Testing shall be based on a minimum of 20 approximately equal size grid spaces per floor or zone with a maximum of 2,500 square foot per test space. Failure of more than one test space shall be considered a test failure.
 - b. In the event that only two test spaces fail the 20-space grid test above, the same floor/zone shall be divided into 40 approximately equal size grid spaces or a maximum of 1,250 square feet per space and re-tested. Failure of only one or only two nonadjacent test spaces on that floor or zone shall result in a non-failure for that floor or zone. Failure of three or more spaces shall result in a test failure for that floor or zone. Failure of two adjacent test spaces shall result in a test failure of that floor or zone.
4. If there is an existing ERRCES and there are grid space test failures resulting in a failed test, notify the Owner in writing immediately about the failed spaces after the completed test and identify the specific areas of the building that are not compliant. The final test result formal submittal data may be submitted at a later date as specified. Contractor may provide recommendations for alterations or

- modifications to the existing system to the Owner/Architect/Engineer so that the deficiencies can be addressed by the Owner as soon as possible and corrective measures taken by the Owner. Make corrective measures or modifications to the existing system only if specifically instructed by the Owner in writing.
5. Two-way radio communications shall be verified by testing the two-way communication to and from the outside of the building from a single point approximately at the center of each test grid space or room area. Retesting from a different point inside the same grid space or room area is prohibited if the first point selected fails the test. The initial failure shall be recorded as a failed test grid space or area.
 6. Signal strength for a non-failure shall be sufficient to meet the requirements of the applications being utilized by public safety for emergency operations through the coverage area as required by the AHJ.
 7. The minimum inbound signal strength shall be sufficient to provide usable voice communications throughout the coverage area as required by the AHJ. The inbound signal level shall be sufficient to provide not less than -95 dBm for analog systems or a Delivered Audio Quality (DAQ) of 3.0 for digital systems or an equivalent Signal-to-Interference-Plus-Noise-Ratio (SINR) applicable to the technology of either analog or digital signals.
 - 8.. The minimum outbound signal strength shall be sufficient to provide usable voice communications throughout the coverage area as required by the AHJ. The outbound signal level shall be sufficient to provide not less than -95 dBm for analog systems or a Delivered Audio Quality (DAQ) of 3.0 for digital systems or an equivalent Signal-to-Interference-Plus-Noise-Ratio (SINR) applicable to the technology of either analog or digital signals.
 9. Buildings with existing ERRCES: Verify the following, include the requested information report deficiencies to the Owner as part of the ERRC report.
 - a. Verify the existing ERRCES is fully monitored by the building fire alarm system as required by NFPA 1221 and NFPA 72.
 - b. If there is an existing remote ERRCES annunciator, verify all annunciators and indicators required by NFPA 1221 are operational and functioning properly.
 - c. The gain values of all existing ERRCES amplifiers shall be measured and documented for comparison for future annual testing of the ERRCES.
 - d. A spectrum analyzer or other suitable test equipment shall be used to verify spurious oscillations are not being generated by existing signal booster(s).
 - e. Verify that the isolation between the donor antenna and all inside antennas is maintained to a minimum of 20dB above system gain.

3.2 SURVEY REPORT SUBMITTALS

- A. Submit summary findings and detailed test report data within 14-days of notice to proceed.
- B. Buildings not in compliance with the ERRC testing: Indicate areas of the building deficient in ERRC. Provide general recommendations of the necessary equipment and means required to bring the building into full ERRC compliance for Owner review in the summary findings. This specification section is only intended for survey, report, and recommendation information only and is not intended for detailed design, modification, or corrective measures. The report data submittal shall be complete in such that it would be useful to assist in a detailed design of a ERRCES. Submit additional report data as indicated below.

- C. Building in compliance with required ERRC: Include a copy of the inspection report to be issued to the AHJ(s) in the format required by the AHJ(s) and submit the report to the AHJ(s) as part of the building permitting process.
- D. Report data submittals shall include but are not be limited the following:
 - 1. Include a copy of survey contractor's AHJ and FCC required licenses to perform the survey.
 - 2. Where there is an existing ERRCES, include an updated ERRCES technical document and yearly report which the Owner shall keep on file as required by NFPA 1221. Technical documents shall in include but may not be limited to the following information typically provided by the AHJ(s):
 - a. Frequencies required by the AHJ(s) for the existing in-building enhancement system (EERCES).
 - b. Location and effective radiated power (ERP) of radio sites used by the public safety radio enhancement system (ERRCES).
 - c. Maximum propagation delay in microseconds.
 - d. List of specifically approved ERRCES components.
 - e. Other supporting technical information necessary for the existing system maintenance, or future modifications.
 - 3. Confirmation that the ERRC for the building that is subject of the report has been determined to meet the minimum coverage requirement as defined by the IBC/IFC, this survey specification section's requirements, and the local AHJ requirements.
 - 4. Include a scaled drawing of the building with RF measurements of each floor or zone of the building which indicates relative RF field strength for each frequency band of interest. Minimum drawing size 11x17-inch, maximum 30x42-inch.
 - 5. The drawings shall indicate clearly the areas that have passed or failed based on the more restrictive of the above parameters or those specifically required by the AHJ.
 - 6. When required by the AHJ, inspection reports by AHJ approved third-party inspector in the format required by the AHJ.

END OF SECTION

SECTION 28 6000
DISTRICT RADIO COMMUNICATIONS EQUIPMENT

PART 1 - GENERAL

1.1 DESIGN AND CONSTRUCTION REQUIREMENTS

- A. Provide a complete and tested Radio Communications System, consisting of an Emergency Radio system and a Radio Repeater system.
- B. Contractor Requirements:
 - 1. Contractor shall provide five years of experience in the installation of radio frequency communications equipment and be a factory authorized dealer and installer for Kenwood equipment. Installation and programming shall be performed by FCC licensed technicians for this type of equipment. The following contractors have been pre-approved by CFISD; other contractors to provide documentation and certification prior to being awarded job.
 - a. Northwest Communications 281-890-4724 (Rick Wright, Don Cameron)
 - b. Texas Bigfoot Communications 713-462-2929 (Rick Cogar)
- C. Submittals (Required):
 - 1. Product Literature: Complete manufacturer's product literature showing electrical characteristics and connection requirements.
 - 2. Wiring Diagram: Indicate system wiring diagram showing each device and wiring connection. Indicate partition layout.
 - 3. Operation and Maintenance Data: Submit manufacturer's standard operating and maintenance instructions.

1.2 WARRANTY

- A. One year from date of substantial completion

PART 2 - PRODUCTS AND MATERIALS

- A. The Emergency Radio system shall include:
 - 1. UHF base station radio supporting the district wide emergency frequency.
 - 2. Mounting antenna in area to provide optimum performance for internal and external communications.
 - 3. Emergency radio and associated equipment shall be installed in mechanical area with the radio repeater.
 - 4. Accessory devices and power supply.
 - 5. Installation of equipment and cabling between antenna and emergency radio.
 - 6. Tone Remotes shall be installed in principal secretary's office and front reception.
 - 7. System setup, frequency programming and testing per CFISD Radio Communications Division requirements.
 - 8. Training shall include demonstration and instructing school staff on operation.
 - 9. Contractor responsible for cable and termination between IDA 24-66M VOIP Remote w/DeskMic and Network.
 - 10. Contractor is responsible for cable and termination between Emergency Radio and network.
 - 11. Equipment:
 - a. Radio: Kenwood NX-5800-K UHF, 45 watts, 450-520 MHz, 1024 channels/128 zones.
 - b. Mounting Case: Control Station mounting case for KPS-15 power supply and NX-5800-K radio
 - c. Power Supply: Kenwood KPS-15 power supply
 - d. Telephone Style Remote Control: IDA 24-66M VOIP Remote w/DeskMic
 - e. Remote Termination Panel: IDA 20-28 VOIP Remote Adapter.

- f. Antenna: Antenex Model FG4603, 3db gain UHF 460-470 MHz omni antenna with mounting bracket
- B. Radio Repeater (Repeater set-up required for ES, MS, HS, Transportation Centers, Stadiums & Multifunction Centers):
 - 1. The Radio Repeater system shall include:
 - a. Radio repeater supporting the campus wide communication.
 - b. Mounting antenna in area to provide optimum performance for campus or facility communications.
 - c. Radio repeater and associated equipment to be installed in mechanical area.
 - d. System setup, frequency programming and testing per CFISD Radio Communications Division requirements.
 - e. Contractor responsible for cable and termination between network adapter and network.
 - f. Contractor is responsible for cable and termination between Kenwood KTI-3 network interface and network.
 - g. 4 post enclosed rack, duplexer, network adapter, and UPS.
 - 2. Equipment:
 - a. Repeater: Kenwood NXR-810K UHF, 1-40W, 450-520 MHz. Operational as analog 25 KHz or 12.5 KHz, or digital 12.5 KHz or true 6.25 KHz
 - b. FCC Licensing: Frequency coordination and acquisition for repeater
 - c. Antenna: CommScope DB404, 450-470 MHz 3.28/5dB gain
 - d. Duplexer: 633-6A-2N, UHF Duplexer 450-470 MHz
 - e. Network Adapter: Kenwood KTI-3 network interface
 - f. Rack: Tripp Lite SR25UB Smart Rack standard-depth half-height server rack enclosure, doors, and side panels
 - g. Power Supply: Minuteman ED2000RTXL2U power supply
 - h. Installation Materials: Connectors, lightning protection, mounting brackets, 5' antenna mast and all other required installation materials for a complete and operational set-up.
- C. Cabling:
 - 1. Provide and install Times LMR-400-LLPL black low loss, plenum rated, indoor/outdoor coax antenna cable with connectors.
 - 2. Provide and install Cat 6 for 24-66M VOIP Remote w/DeskMic in principal secretary's office and front reception to network. Reference Division 27 10 00.
 - 3. Provide and install Cat 6 for IDA 20-28 VOIP Remote Adapter at the emergency radio to the network. Reference Division 27 10 00.
 - 4. Provide and install Cat 6 cable for Kenwood KTI-3 network interface at the radio repeater to the network. Reference Division 27 10 00.

PART 3 - EXECUTION

- A. Demonstration and Training:
 - 1. A written test report from an authorized representative that the system has been 100% tested and is functioning properly shall be submitted prior to training and demonstration.
 - a. Contractor shall demonstrate system operation to DVISD security personnel and project manager.
 - b. Contractor shall provide one hour of instruction each for two of owner's personnel, to be conducted on site with the manufacturer's representative.

END OF SECTION

**SECTION 31 0000
EARTHWORK UNDER BUILDING PAD**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Protecting and preserving trees and vegetation to remain.
- B. Clearing, stripping, and grubbing of portions of sites which are below the building pads.
- C. Stockpiling stripped topsoil in approved locations.
- D. Excavating for and otherwise providing stable and compact subgrade below the building pads.
- E. Placing and compaction of select fill under improved areas to conform to elevations indicated on the drawings.
- F. Filling and finish grading of area around buildings and other improvements using imported topsoil per section 2.1,D.
- G. Coordinating Work of other Sections affecting or affected by Work of this Section.

1.3 INSPECTION OF SITE

- A. By making a proposal on the Project, the Contractor acknowledges:
 - 1. That the Owner and Architect do not guarantee the accuracy, completeness, or suitability of the contents of the Geotechnical Report or Topographic Survey.
 - 2. That he/she has visited the site to investigate the conditions affecting the Work and has satisfied himself/herself of the character, quality and quantity of surface and subsurface materials or obstacles to be encountered.
- B. The Contractor will be required to establish, maintain and be responsible for all reference points, hubs, grades, elevations, lines, and surface measurements. If any discrepancies in the documents are found, the Contractor shall promptly notify the Architect and await instructions before proceeding.

1.4 QUALITY ASSURANCE

- A. Inspection and Testing Laboratory Services: Test results shall meet or exceed the standards referenced.

1.5 REFERENCES

- A. ASTM International (ASTM)

1. D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft³ (600 kN-m/m³) – Test for Moisture Unit Weight Relations of Soils and Soil Aggregate.
2. D2922, Tests for Density of Soil and Soil Aggregate in place by Nuclear Methods.

1.6 PRE-INSTALLATION CONFERENCE

- A. Refer to Section 01 31 13- Project Management and Coordination.

PART 2 - MATERIALS

2.1 MATERIALS

- A. Structural Fill: Sandy clay soils free of organic or other deleterious materials, and have a maximum clay lump size of less than three (3) inches. See Construction Documents for Liquid Limit and Plasticity Index per soils report.
- B. Earth Fill: Shall be excavated material approved by Architect prior to its use as earth fill around building and landscaped areas, but not under building.
- C. Stabilization Materials: Refer to stabilization section(s) in Division 31.
- D. Topsoil: Shall be imported, and shall be free from clay, vegetation, debris, stumps, roots, stones larger than 3/4 inch diameter, or other objectionable matter.

PART 3 - EXECUTION

3.1 GENERAL

- A. Unknown Utilities and Obstacles:
 1. If any unknown or uncharted utilities or objects are encountered during excavation, promptly notify the Architect before proceeding. Arrange with utility and telephone companies for removal and relocation of their equipment, and capping of pipes and wiring as required.
- B. Protection of Vegetation:
 1. Rope or fence off areas of the site that are designated to remain with vegetation to prevent vehicular traffic and construction damage.
 2. Provide wood barricades around trees and shrubs at their drip line in traffic areas to protect them from construction operations until Substantial Completion, or until barricade removal is directed by Architect.
 3. Replace damaged trees and vegetation designated to remain with vegetation of equal kind and size. Follow supplier's recommended procedures for planting necessary replacement vegetation.
- C. Clearing, Stripping and Grubbing (General):
 1. Remove brush, vegetation, debris, and surplus materials from the jobsite. Removal of other remaining impediments as may be necessary to properly execute the scope of this contract shall be included herein. Adhere to State and local code requirements for the disposal of trees and shrubs removed from the site.

2. Do not remove trees or shrubs without the specific approval of the Architect. Vegetation damaged, removed, killed, or constricted from normal growth patterns shall be replaced with a comparable item, or the full replacement amount credited to the Owner.
- D. Drainage, Pumping and Grading:
1. Proper drainage of site shall be maintained during construction so that ponding of surface runoff does not occur and cause construction delays and/or inhibit access to the site.
 2. Contractor shall control the grading around building so that ground is pitched to prevent water from running into the excavated areas of building or damaging other structures.
 3. Provide pumping required to keep excavated spaces clear of water during construction.
 4. If any subgrade is damaged due to flooding, damaged area shall be removed and filled with select fill. Placement and compaction of select fill shall meet the requirements for placing and compacting select fill as specified below.
 5. If the subgrade, due to any reason or cause, lose the required stability, density, or finish before the foundation structure is placed, it shall be re-compacted and refinished at the sole expense of the Contractor.

3.2 BUILDING FOUNDATION (PAD) PREPARATION

- A. Site preparation area at buildings with and without adjacent sidewalks shall extend beyond the limits of the foundation area. See Construction Documents for Site Preparation limits.
- B. Existing fill material, top soil vegetation, roots, debris, organic material and other miscellaneous debris shall be removed to a depth of 9 inches and legally disposed of. Actual removal depth may vary and will be determined at time of construction.
- C. Over excavate the in-situ soils as required to allow the minimum amount of select structural fill to be placed beneath the slab to achieve the desired elevation. See Construction Documents for amount of select structural fill required per soils report.
- D. After stripping, and excavating to the desired grade as indicated above, the exposed soil shall be proof-rolled to locate all soft or loose areas. Soils, which are observed to rut or deflect excessively under the moving load, shall be undercut and replaced with properly compacted structural fill. The proof-rolling and undercutting activities shall be witnessed by a representative of the geotechnical engineer and shall be performed during a period of dry weather.
- E. Subsequent to proof-rolling, and just prior to placement of fill, the exposed subgrade within the construction areas shall be evaluated for moisture and density. The subgrade soils shall be at or above the optimum moisture content, and have an in-place dry density of at least 95 percent of the standard effort (ASTM D698) maximum dry density of the in-situ soils. If the moisture or density does not meet the above criteria, the subgrade shall be scarified to a minimum depth of 6 inches, and moisture adjusted to meet the requirements per the soils report as indicated on the Construction Documents.
- F. If remediation is required, Contractor shall have any of the following remediation options:
 1. Disking and drying with natural means (if the construction schedule allows).

2. Dry the surface soils by chemically treatment.
3. Remove the unsuitably wet soils and replace the wet soil with select fill having an acceptable moisture content.

The option will be entirely up to the Contractor and no extra will be paid by the Owner.

- G. After proof-rolling and undercutting has been completed, and the subgrade tested and adjusted as necessary, fill placement may begin. The first layer of fill shall be placed in a relatively uniform horizontal lift and be adequately keyed into the stripped subgrade soils.
- H. Refer to construction drawings for information regarding lime-stablized subgrade treatment.

3.3 FILL PLACEMENT

- A. Structural fill materials shall be as specified in Paragraph 2.1, A above. Structural fill shall be placed in maximum lifts of eight (8) inches of loose material and shall have a moisture content as indicated on the Construction Documents. If water must be added, it shall be uniformly applied and thoroughly mixed into the soil by disking or scarifying. Each lift of structural fill shall be tested by a representative of the geotechnical engineer prior to placement of subsequent lifts.
- B. Each lift of structural fill shall be compacted as required per the soils report and as indicated on the Construction Documents. Care shall be taken to apply compactive effort throughout the fill and fill scope areas. The moisture content and the degree of compaction of the structural fill soils shall be maintained until the construction of structures above them.
- C. Contractor shall be responsible for damage caused to structure because of over excavation or excavations left open during inclement weather. Should the subgrade, for any reason or cause, lose the required stability, density, or finish before the foundation structure is placed, it shall be re-compacted and refinished at the sole expense of the Contractor.

3.4 GRADING

- A. Rough Grading: Contractor shall control the grading around building so that ground is pitched to prevent water from running into the excavated areas or damaging other structures. Furnish pumping required to keep excavated spaces clear of water during construction. If a foundation excavation must remain empty through a shut-down period, cover with boards and building paper and clean out immediately when work resumes. If any subgrade should be damaged due to flooding, damaged area shall be removed and filled with select fill.
- B. Finish Grading:
 1. After rough grading is completed, provide and place imported top soil in the amounts required to bring the rough grade to within two (2) inches of finish grade. This earth fill shall be placed in lifts not to exceed 12 inches after compaction and shall be compacted to a dry density of at least 95 percent of the ASTM D698 maximum dry density.
 2. Assure bonding of layers of fill material in compliance with the specifications.

3. Final and fine grading shall be done using a tractor pulled landscape rake and hand raking removing all debris immediately prior to landscaping. The final graded ground surface shall be relatively smooth, free of organic material and in suitable condition to commence landscaping work.
- C. Topsoil:
1. Contractor shall furnish all topsoil that may be required to provide finish elevations. Topsoil material shall meet requirements of Paragraph 2.1 of this Section. Spread minimum two (2) inches of topsoil over graded areas after rough grading has been completed.
 2. At the completion of finish grading, ground surface shall be relatively smooth, free of organic material and in suitable condition to commence landscaping work.

3.5 INSPECTION AND TESTING LABORATORY SERVICES

- A. Refer to Section 01 4523, Inspection and Testing Laboratory Services for laboratory services to determine the liquid limit, plastic limit and plasticity index for soils and in-place density tests for compacted material.
- B. The Contractor shall cooperate with the inspection and testing laboratory in all matters pertaining to the work.

END OF SECTION

**SECTION 31 000
EARTHWORK**

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and perform all excavation, backfill, fill and grading required to complete the work as shown on the Drawings and as specified herein. The work shall include, but not necessarily be limited to; excavation and backfill for electrical manholes, handholes, conduits, cables, raceways and ducts; embankment and grading; disposal of waste and surplus materials; and all related work such as sheeting, bracing, and dewatering.
- B. All excavation, trenching and related sheeting, bracing, etc, shall conform to the requirements of the Florida "State Safety Act" (CS/SB 2626) which incorporates, by reference, OSHA's excavation safety standards, 29 CFR 1926.650 Subpart P.
- C. Excavation, backfill, and compaction for structures and piping are included in other sections as listed below.

1.02 RELATED WORK

- A. Dewatering and Drainage is included in Section 312319 and 014127.
- B. Rock and Boulder Excavation is included in Section 312319.
- C. Structural Excavation Backfill and Compaction is included in Section 312319.
- D. Trenching, Bedding and Backfill for Pipe is included in Section 312323 and 314000.

1.03 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM) 1. ASTM C33 - Specification for Concrete Aggregates.
 - 2. ASTM D1557- Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,00 ft-lbf/ft (2,700kN-m/m)
 - 3. ASTM D1682- Standard Test Methods for Breaking Load and Elongation of Textile Fabrics.
 - 4. ASTM D2487 - Standard Classification of Soils for Engineering Purposes.
 - 5. ASTM D4751- Standard Test Method for Determining the Apparent Opening Size of a Geotextile.
- B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.04 PROTECTION

A. Sheeting and Bracing

1. Furnish, put in place and maintain such sheeting and bracing as may be required: by Federal, State and local safety requirements; to support the sides of excavations; to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction; and to protect adjacent structures from undermining or other damage. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed. Where soil cannot be properly compacted to fill a void, lean concrete shall be used as backfill.
2. In order to protect adjacent structures, installation or removal of sheeting by vibratory or hammering methods shall not be allowed.
3. Construct the sheeting outside the neat lines of the foundation, unless indicated otherwise, to the extent deemed desirable for the method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting and bracing shall be adequate to withstand all pressures to which the structure or trench will be subjected. Any movement or bulging which may occur shall be corrected to provide the necessary clearances and dimensions.
4. Where sheeting and bracing is required to support the sides of excavations for structures, engage a professional Engineer, registered in the State of Florida to design the sheeting and bracing. The sheeting and bracing installed shall be in conformity with the design and certification of this shall be provided by the professional Engineer. Submit P.E. Certification Form contained in Section 01 33 23 to show compliance with this requirement.
5. All sheeting and bracing not left in place shall be carefully removed in such manner as not to endanger the construction or other structures, utilities, or property. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools especially adapted to that purpose, or otherwise as may be directed.
6. The right of the ENGINEER to order sheeting and bracing left in place shall not be construed as creating any obligation on his/her part to issue such orders and his/her failure to exercise his/her right to do so shall not relieve the CONTRACTOR from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the CONTRACTOR to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.
7. No sheeting is to be withdrawn if driven below mid-diameter of any pipe and under no circumstances shall any sheeting be cut off at a level lower than 1-ft above the top of any pipe.

B. Pumping and Drainage

1. At all times during construction provide and maintain proper equipment and facilities to remove all water entering excavations and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fills, structures or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels. Engage a Geotechnical Engineer

registered in the State of Florida to design the dewatering system in accordance with Section 31 2319 prior to commencing work.

2. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation. Well or sump installations shall be constructed with proper sand filters to prevent drawing of finer grained soil from the surrounding ground.
3. Take all additional precautions to prevent uplift of any structure during construction.
4. Remove the dewatering equipment after the system is no longer required.

1.05 SOIL TESTING

- A. Previous to the general placement of the fill and during such placement, the ENGINEER may select areas within the limits of the fill for testing the degree of compaction obtained. Cooperate fully in obtaining the information desired.
- B. Payment for testing will be made by the ~~OWNER~~ CONTRACTOR as part of the project. If test results are unsatisfactory, all costs involved in correcting deficiencies in compacted materials to the satisfaction of the ENGINEER, will be borne by the CONTRACTOR.-

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Select Common Soil and Structural Fill shall be as specified in Section 312323.
- B. Common soil shall be as specified in Section 312323.
- C. Crushed Stone
 1. Crushed stone shall conform to Florida Department of Transportation Class 57 stone gradation.
- D. Screened Gravel
 1. Screened gravel shall be used for pipe bedding as detailed and at other locations indicated on the Drawings.
 2. Screened gravel shall consist of hard, durable, rounded or subangular particles of proper size and gradation and shall be free from sand, loam, clay, excess fines and deleterious materials. The gravel shall be graded within the following limits:

<u>Sieve Size</u>	<u>Percent Finer by Weight</u>
5/8-in	100
1/2-in	40 to 100
3/8-in	15 to 45

No.10

0 to 5

PART 3 - EXECUTION

3.01 BACKFILLING - COMMON FILL

- A. Common Fill may be used as trench backfill and fill against exterior walls of structures as indicated on the Drawings; as embankment fill; or in other areas as designated by the ENGINEER. Material conforming to the requirements of common fill shall be placed in layers having a maximum thickness of 2-ft measured before compaction.
- B. Common Fill shall be compacted to at least 95 percent of maximum density as determined by ASTM D1557, Method D.
- C. Materials placed in fill areas shall be deposited to the lines and grades shown on the Drawings making do allowance for settlement of the material and for the placing of loam thereon.
- D. The surfaces of filled areas shall be graded to smooth true lines, strictly conforming to grades indicated on the grading plan and no soft spots or uncompacted areas will be allowed in the work.
- E. No compacting shall be done when the material is too wet either from rain or from excess application of water. At such times, work shall be suspended until the previously placed and new materials have dried sufficiently to permit proper compaction.

3.02 DISPOSAL OF SURPLUS MATERIAL

- A. No excavated materials shall be removed from the site of the work or disposed of, except as specified by the ENGINEER. Materials shall be neatly piled so as to inconvenience as little as possible the public and adjoining property OWNERS until used or otherwise disposed of as specified below.
- B. Suitable excavated material shall be used for fill embankments or backfill on the different parts of the work as required.
- C. Surplus fill shall become the property of the CONTRACTOR and shall be removed and disposed offsite.

3.03 DISPOSAL AND REPLACING OF ROCK

- A. Remove and dispose of all pieces of ledge and boulders which are not suitable for use in other parts of the work. Rock disposed of by hauling away to spoil areas is to be replaced by approved surplus excavation obtained elsewhere on the work, insofar as it is available. Any deficiency in the backfill material shall be made up with acceptable material approved by the ENGINEER.
- B.

- C. Fragments of ledge and boulders smaller than 50 lb weight may be used in backfilling trenches unless in the opinion of the ENGINEER the quantity is excessive, in which case he/she may order the removal and disposal of some of this rock. The small pieces of rock used as backfill shall not be placed in trenches until the pipe has at least 2-ft of earth over it. Place these pieces of stone in thin layers alternating them with earth to be sure that all voids between the stones are completely filled with earth to prevent the occurrence of voids and settlement which will result therefrom.
- D. Rock may be used in embankment fill only with the approval of the ENGINEER.

3.04 GRADING

- A. Grading in preparation for placing of loam, planting areas, paved walks and drives and appurtenances shall be performed at all places that are indicated on the Drawings, to the lines, grades and elevations shown and otherwise as directed by the ENGINEER and shall be performed in such a manner that the requirements for formation of embankments can be followed. All material encountered, of whatever nature, within the limits indicated, shall be removed and disposed of as directed. During the process of grading, the subgrade shall be maintained in such condition that it will be well drained at all times. When directed, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the prosecution or condition of the work.
- B. If at the time of grading it is not possible to place any material in its final location, it shall be stockpiled in approved areas for later use. No extra payment will be made for the stockpiling or double handling of excavated material.
- C. The right is reserved to make minor adjustments or revisions in lines or grades if found necessary as the work progresses, in order to obtain satisfactory construction.
- D. Stones or rock fragments larger than 4-in in their greatest dimensions will not be permitted in the top 6-in of the finished subgrade of all fills.

END OF SECTION

**SECTION 31 1100
CLEARING AND GRUBBING**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies the requirements for Site clearing which may consist of:
1. Protection of trees indicated to be preserved.
 2. Protection of above-ground and below-ground existing improvements indicated to be preserved.
 3. Clearing, grubbing, removal and disposal of trees, stumps, brush, roots, vegetation, logs and rubbish.
 4. Removal and disposal of above-ground and below-ground materials and existing improvements, including building demolition if any, as indicated.
 5. Stripping and stockpiling of topsoil.
 6. Stripping and stockpiling natural leaf mulch.

1.2 SUBMITTALS

- A. In accordance with Section 00 72 00 – Uniform General Conditions, Sub-Section UGC 8.3 for Texas State University System (TSUS) projects.

1.3 JOB CONDITIONS

- A. Conduct demolition operations and removal of debris in accordance with governing regulations and Section 024117 - Demolition of these Specifications.
- B. Ensure minimum interference with adjacent occupied or used facilities.
- C. Exercise care to protect adjacent building, structures, and persons.
- D. Above-ground and below-ground existing improvements, indicated to remain, shall be protected from damage prior to and during construction operations.
- E. Tree Protection
1. Trees to be preserved shall be protected by barricades to avoid any confusion and damage prior to site clearing operations.
 2. Contractor shall install barricades 3 ft. beyond drip line of trees to be protected. Construction equipment or storage activities shall not be permitted within the fenced area.

F. Protection of Existing Utilities and Adjacent Work

1. Prior to earthwork operations, existing utilities, facilities and permanent objects to remain shall be located and adequately protected. When working near public and private utility company lines, Contractor shall contact the local utility coordinating committee, or the utility company involved to locate their lines.
2. If unknown and uncharted utilities are encountered during excavation, promptly notify Owner and the governing utility company when determinable and wait for instructions.
3. If it is determined by Owner that such utility line has been abandoned, properly cap line at a depth approved by Owner or remove line as directed.
4. If such unknown utilities are encountered and work is continued without contacting the Owner for instructions, and the encountered utilities are damaged by continuation of the work, Contractor shall repair, at this own expense, such damage to the satisfaction of the Owner and the Utility Company. The Contractor shall be responsible for all costs to repair the damage.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 CLEARING

- A. Trees to be removed, stumps, brush, roots and vegetation shall be removed to a depth of not less than 2 feet below original or finish ground level, whichever is lower.
- B. Miscellaneous vegetation, logs and rubbish shall be removed in their entirety, within the limits of improvements.
- D. Topsoil shall be stripped to underlying subsoil. Topsoil shall be defined as friable organic clay loam surface soil, reasonably free of clay lumps, stones, weeds, roots and other objectionable material. Topsoil shall be safely stockpiled on the Site. Stockpiles shall be constructed to freely drain surface water.
- E. Depressions caused by clearing, grubbing and stripping operations shall be filled with approved backfill material, unless further excavation is required by the construction operations. Backfill shall be placed in accordance with Section 312300 – Excavation, Grading, and Fill of these Specifications.

3.2 REMOVAL OF IMPROVEMENTS

- A. Above-ground and below-ground existing improvements shall be removed in their entirety, except for utilities which shall be removed only to the extent indicated. Where utilities are indicated to be removed in part, the ends of the remaining utilities shall be permanently plugged with Class 3000 concrete.

3.3 DISPOSAL OF MATERIALS

- A. Materials not scheduled to be salvaged shall become the property of the Contractor and shall be

removed from the Site and legally disposed of. Burning or burying cleared, grubbed and demolition waste materials on the Site shall not be permitted. Remove items, without damaging, scheduled to be salvaged as directed by the engineer and placed in designated storage area.

END OF SECTION

SECTION 31 2300
GRADING EXCAVATION AND FILL

PART 1 - GENERAL

1.1 Related work specified elsewhere

- A. Protection of trees.
- B. Field engineering for site layout.
- C. Testing laboratory services.
- D. Fill material for pavement subbase.
- E. Concrete reinforcing.
- F. Cast-In-Place concrete.
- G. Informational reference to site survey and to subsurface conditions.

1.2 Quality assurance

- A. Reference standards:
 - 1. ASTM D 698, test for moisture-density relations of soils (Standard Proctor).
 - 2. ASTM D 2922, test for density of soil in place by nuclear method.
 - 3. ASTM D 2487, classification of soils for engineering purposes.

1.3 Submittals

- A. Samples:
 - 1. Submit 10 pound sample quantity of fill materials.
 - 2. Submit 20 pound sample quantity of topsoil material.
 - 3. Pack tightly in containers to prevent contamination.

1.4 Grades

- A. Carefully compare new grade requirements with existing conditions.
- B. Provide necessary earth, grading and shaping work.
- C. Extra payment will not be authorized for overage or shortage of material.

PART 2 – PRODUCTS

2.1 Materials

- A. Sub base Material: Unwashed pit run or crushed gravel, crushed stone, or crushed slag, naturally or artificially graded with maximum aggregate size of 1-1/2 inches, as acceptable to testing laboratory.
- B. Backfill and Fill Material: Soil materials free of debris, waste, frozen matter, vegetable and other deleterious matter, as acceptable to testing laboratory.
- C. Select Fill: Imported lean clay with a narrow plasticity index (pi) range of 10 to 15.
- D. Lime Treated Structural Fill: On-site clay mixture, free of silt, loam, friable or soluble materials and organic matter; treated in 6 inch lifts with 36 pounds per square yard of hydrated lime.
- E. Backfill:
 - 1. Free from rocks larger than 3 inches in size, alkali, salt, petroleum products, debris, waste, roots, vegetable and other deleterious matter.
 - 2. Excess non-vegetated excavated soils available from site may be used if conforming to specified requirements.
- F. Lime: Material conforming to SDHPT item 264, "Hydrated Lime and Lime Slurry".
- G. Soil Filter Fabric: Mirafi "1405" is specified; Dupont "Tygar" is acceptable, or approved equal.

PART 3 - EXECUTION

3.1 Obstructions

- A. Remove obstructions within lines of improvements.
- B. Refer obstructions of questionable nature to engineer.
- C. Remove abandoned foundations down to 12 inches below finished grade, or the finished elevation of pavements and walks unless indicated otherwise on the drawings.
- D. Remove foundations of light standards completely.

3.2 Stripping

- A. Strip entire area to receive pavement and slabs on grade to a minimum depth of six inches to remove soil containing vegetated material.
- B. Remove vegetated material from site as waste.
- C. Remove topsoil; spread on areas already graded and prepared for topsoil, or deposit in storage piles convenient to areas subsequently to receive topsoil.

- D. Scarify existing asphalt surfacing and flexible base course material and remove from site.
- E. Remove existing site improvements in areas scheduled to receive lawns, buildings, and pavements.
- F. Stripped material becomes property of Contractor; remove from Project site immediately and dispose of properly.
- G. Maintain site surface drainage during construction.

3.3 Excavation and compaction below grade beams and slabs-on-grade

- A. Excavate sub grade for the building footprint to allow a minimum of 4 feet of thickness below the bottom of the slabs-on-grade .in accordance with lines and grades required for construction of the work, including space for placing and removal of forms, bracing and shoring, for inspection and a minimum of 5 feet beyond the building line.
- B. Maintain excavations free of loose earth, debris, and keep dry until placement of concrete.
- C. Proof roll the soil at the base of the excavation using a rubber-tired vehicle weighing about 20 tons, such as a loaded dump or water truck.
- D. Remove and replace any soft or weak soils identified. Disking, drying and recompaction during dry weather or treatment with a chemical additive may be used as needed as remedial options.
- E. Place a minimum 3 feet thickness structural fill and select as recommended by the soils report, fill as indicated, in consecutive 8 inch maximum loose lifts. Compact any lime treated clay and select fill to at least 95 percent of the standard proctor maximum density according to astm d 698.
- F. If high moisture content is determined by ASTM D 698, compare the in-place density of lime-treated clays with 90 percent of the maximum density determined by modified effort according to ASTM D 1557, if required. The actual range of moisture within which specified compaction can be achieved may be adjusted once the moisture-density relationship for the structural fill has been developed.
- G. Protect open excavations with coverings as necessary to maintain existing soil moisture content.

3.4 Excavation for Utility Trenches

- A. Excavate using ladder-type trenching machine or backhoe unless indicated otherwise.
- B. Cut trench sides vertical from trench bottom to one foot above top of pipe; slope back on stable slope above that point.
- C. Extend trench width minimum 6 inches and maximum 18 inches each side of pipe.
- D. Excavate trench to a minimum depth of 4 inches below bottom elevation of proposed pipelines.
- E. Leave no more than 500 feet of trench open at one time.

- F. Where augured hole is indicated, provide opening no larger than one inch greater than outside diameter of pipe bell.

3.5 Dewatering

- A. Keep excavations dry; maintain dewatered condition for depth of one foot below excavation bottom.
- B. Operate suitable pumps necessary to keep excavations continuously free of water.
- C. Discharge drainage waterlines into approved sewers only with appropriate approvals; use of sanitary sewer is prohibited.
- D. Direct surface drainage away from excavated areas.
- E. Control grading adjacent to excavations to prevent water running into excavated areas.

3.6 Perimeter Backfill

- A. Backfill exterior side of perimeter of structure with lime-treated on-site clay materials, carrying such fill up to indicated sub grades.
- B. Backfill systematically and as early as possible to allow maximum time for natural settlement and compaction.
- C. Commence backfilling after underground work has been inspected, tested, forms removed, and excavation cleaned of trash and debris.
- D. Place and compact backfill to minimize settlement and avoid damage to work in place.
- E. Place backfill simultaneously on both sides of freestanding structures; prevent wedging action against structure.
- F. Place materials in successive horizontal layers of not more than 8 inches (4 inches for hand- held tamping equipment) and uniformly compacted to 92% of maximum density as confirmed by testing laboratory.

3.7 Utility Trench Backfill

- A. Pipe bedding and backfill requirements for sanitary sewers shall be as specified in Section 333100, SANITARY SEWAGE SYSTEMS.
- B. Pipe bedding and backfill requirements for storm sewers shall be as specified in Section 334100, STORM SEWAGE SYSTEMS.
- C. Pipe bedding and backfill for water distribution system piping shall be as specified in Section 330528 TRENCHING AND BACKFILL FOR UTILITIES.
- D. Backfill trench as soon as possible after pipe has been laid, jointed, and inspected; complete backfilling at end of each day.

- E. Within pipe zone: place backfill material and hand tamp in 6 inch layers to one foot above top of pipe.
- F. Use of bulldozer or similar tracked equipment is unacceptable for compaction.

3.8 Preparation of subgrade for paving, walks and exterior slabs

- A. Cut and fill areas as required.
- B. Proof roll sub grade with heavy roller. Cut out any soft area that cannot be compacted by surface rolling and replace with compacted select fill.
- C. Provide select fill at areas where required to elevate sub grade. Lime stabilization: stabilize to depth of 8 inches with lime slurry in accordance with TxDOT Item 260. Subgrade beneath side-walks shall not be lime stabilized.
- D. Compact to not less than 85 to 92% of maximum density in accordance with ASTM D 698 as confirmed by testing laboratory; with moisture content for compacted material within +/- 2% of optimum moisture.
- E. Maintain site surface drainage during construction.

3.9 Rough grading

- A. Shape sub grade to allow for maximum amount of natural settlement and compaction.
- B. Remove debris, roots, branches, stones, in excess of 2 inches in size.
- C. Remove subsoil which has been contaminated with petroleum products.
- D. Excavate areas, to sub grade elevation, which are to receive paving and sidewalks.
- E. Bring sub grade to required levels, profiles and contours, making gradual changes in grade; blend slopes into level areas.
- F. Slope grade away from building minimum 2 inches in 10 feet unless indicated otherwise.
- G. Cultivate sub grade to a depth of 3 inches where topsoil is to be placed; repeat cultivation in areas where equipment used for hauling and spreading topsoil has compacted sub grade.

3.10 Maintain site surface drainage during construction.

3.11 Surplus materials

- A. Remove surplus subsoil from site.
- B. Leave stockpile areas and entire job site clean and raked, ready to receive landscaping.

3.12 Clean-up

- A. Remove temporary structures, rubbish, and waste materials from work site daily.

END OF SECTION

**SECTION 31 2500
EROSION AND SEDIMENTATION CONTROL**

PART 1 – GENERAL

1.1 Scope of Work

- A. This Section pertains to the provisions for the control of erosion in the construction area and in stockpile areas including seeding, the construction of temporary swales and sedimentation basins as required and shown on the drawings. All areas where existing vegetation and grass cover have been bared by construction activities shall be protected from erosion.
- B. Contractor is responsible for meeting all local, state and federal regulations regarding erosion control including the applicable provisions of the National Pollution Discharge Elimination System, Phase II, regulations from the Clean Water Act.

1.2 Related Work Specified Elsewhere

- A. Drawings and general provisions of the Contract, including A-Procurement and Contracting Requirements, Division 00 and Division 01 apply to this section.
- B. Section 31 11 00 Clearing and Grubbing
- C. Section 31 23 00 Grading Excavation and Fill
- D. Section 33 05 28 Trenching and Backfill for Utilities
- E. Texas Department of Transportation's Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges (2014)

1.3 Permits (Not Used)

1.4 Applicable Publications (Not Used)

1.5 Protection of Adjacent Work (Not Used)

1.6 Definitions

- A. Best Management Practices (BMP's) means physical facilities schedules of activities, prohibition of practices, maintenance procedures, and other management practices , when properly designed, installed, and maintained, will be effective to prevent or reduce the discharge of pollution associated with construction activities. BMP's also include treatment requirements, operating procedures, and practices to control site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.
- B. Block Sodding: Sodding for erosion control and for final stabilization shall consist of providing and planting Bermuda grass, San Augustine grass, or other acceptable sod along or across such areas as are designated on the drawings and in accordance with the specification requirements herein outlined.
- C. Hydromulch Seeding: Seeding, followed by the application of a mulch erosion control blanket shall consist of preparing the ground, sowing of seeds, application of a fertilizer, and stabilization with mulch consisting of a biodegradable fiber along and across such

areas as are designated on the plans and in accordance with these specifications

- D. Silt Fence: The reinforced filter fabric barrier consists of geotextile fabric supported by a net reinforced fence stretched across and attached to supporting posts or frame and entrenched. Work shall be performed during construction operations and prior to final stabilization to control erosion and sedimentation as designated on the plans and in accordance with these specifications.
- E. Inlet Protection Barriers: The inlet protection barrier consists of a geotextile fabric (filter fabric) supported by a net reinforced fence structure and constructed around a storm drain inlet, catch basin, or culvert. An alternative design of the inlet protection barrier, as approved by the Engineer, consists of fiber rolls placed around a frame, staked in place (or weighted down with clean gravel bags), and constructed around a storm drain inlet, catch basin or culvert. This work shall be performed during construction operations and prior to final stabilization to control erosion and sedimentation. As designated on the plans and in accordance with these specifications.
- F. Sediment Basins: A sediment basin is a temporary basin or dam constructed across a waterway or excavated location to intercept sediment-laden runoff and to trap and retain the sediment. A sediment basin is usually installed at points of discharge from drainage areas greater than 5 acres. Work shall be performed during construction operations and prior to final stabilization to control erosion and sedimentation as designated on the plans and in accordance with these specifications.
- G. Stabilized Construction Access: This work shall consist of the installation of temporary erosion protection and sediment control stabilized construction access - type I, rock, utilized during construction operations and prior to final stabilization, in accordance with these specifications and construction drawings
- H. Rock Filter Dams: Rock filter dams are temporary berms constructed of stone to intercept and slow storm water runoff to retain sediment on the construction site.
 - 1. Depending upon the type of rock filter dam specified in the construction plans as Type 1, 2, 3, or 4, the aggregate fill may be unwrapped, wrapped in twisted hexagonal wire mesh, or confined in a gabion wire basket. Applications of RockFilter Dams are as follows:
 - a. Type 1 dams may be used at toe of slopes, around inlets, in small ditches, and at dike or swale outlets. Type 1 dams are recommended for erosion and sediment control from a drainage area of 5 acres or less.
 - b. Type 2 dams may be used in ditches and at dike or swale outlets.
 - c. Type 3 dams may be used in stream fl
 - d. Type 4 sack gabions may be used in ditches and smaller channels to form an erosion and sediment control dam

1.7 Quality Assurance

- A. Codes and Standards: Install and maintain erosion control systems in compliance with all authorities having jurisdiction.

1.8 Project/Site Conditions (Not Used)

1.9 Submittals (Not Used)

PART 2 – PRODUCTS

2.1 Sustainable Materials

- A. Contractor shall strive to utilize sustainable materials, which include rapidly renewable materials, regional materials, regionally manufactured materials, regionally extracted materials, recycled contents.

2.2 Grass

- A. Materials for erosion control seeding shall conform to TxDOT Item 164.
- B. Materials for erosion control sodding shall conform to TxDOT Item 162.

2.3 Fertilizer

- A. Materials for fertilizing erosion control seeding and/or sodding shall conform to TxDOT Item 166.2

2.4 Water

- A. Use clean potable water for maintaining the grass developed after erosion control seeding and/or sodding. Water shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable matter or other substances injurious to the finished product.
- B. Water sources other than the local municipal domestic water supply must be approved by the Owner.
- C. If onsite reclaimed water sources are used, tanks and appertices must be clearly marked with the words “non-potable” water.

2.5 Silt Fence

- A. Geotextile fabric for Silt Fences must meet the TxDOT Departmental Material Specifications DMS 6230 Temporary Sediment Control Fence Fabric.

2.6 Straw Bales

- A. Standard rectangular hay bales bound by baling wire, clean and dry

2.7 Inlet Protection Barriers

- A. Geotextile per 2.5 Silt Fence above.
- B. Hardwood Posts shall be 2x2 minimum length 4 feet.
- C. Net reinforced fence shall be 2 inch by 4 inch welded wire fabric mesh. The mesh support height shall be the equivalent height, or greater, of the geotextile fabric to be attached.

2.8 Stabilized Construction Access

- A. Materials to be per TxDOT spec section 506.2.E.1 for Type 1

2.9 Rock Filter Dam

- A. Materials. Geotextile fabric shall consist of a woven monofilament or spunbond nonwoven fibers consisting of long-chain synthetic polymers composed of at least 95 percent by weight of polyolefins. Geotextile fabric shall equal or exceed the following average roll values or as directed by the Engineer:
1. Minimum average roll value.
 - a. Elongation – 50 percent.
 - b. Grab Strength – 200 pounds.
 - c. Puncture Strength – 75 pounds.
 - d. UV Stability (retained strength) – 50 percent after 500 hours of exposure.
 2. Maximum average roll value.
 - a. Apparent Opening Size (AOS) – 0.6 mm/#30 US sieve.
- B. Geotextile fabric shall be resistant to commonly encountered soil chemicals, mildew, rot, insects, and deterioration resulting from exposure to sunlight or heat. Geotextile fabric shall provide an expected useable life comparable to the anticipated construction period.
- C. Aggregate for the rock filter dams shall consist of crushed stone. Aggregate particles shall be composed of clean, hard, durable materials free from adherent coatings, salt, alkali, dirt, clay, loam, shale, soft or flaky materials or organic and injurious matter. Aggregate shall be cubic or rounded form, not elongated, flat, shapes. Spalls, fragments, and chips shall not exceed 5 percent by weight. Crushed concrete shall not be substituted for the crushed stone unless as approved by the Engineer. Aggregate size shall depend upon the type of rock filter dam specified in the construction plans. Aggregate size based on type of rock filter dam is as follows:
1. Type 1: 3 inches to 5 inches, open-graded.
 2. Type 2: 3 inches to 5 inches, open-graded.
 3. Type 3: 4 inches to 8 inches, open-graded.
 4. Type 4: 3 inches to 5 inches, open-graded.
- D. Mesh is required for reinforced type rock filter dams. Mesh shall be 20 gauge galvanized double twisted hexagonal wire mesh with 1-inch diameter hexagonal openings. Mesh wire shall be zinc coated prior to being double twisted. Reinforcing spiral binders, lacing wire, and stiffeners shall be made of wire having the same coating material and same wire size as the wire mesh. Gabion wire baskets shall equal or exceed the requirements of the wire mesh.

PART 3 – EXECUTION

3.1 General

A. Protection

1. Protect benchmarks, monuments, existing structures, existing fences, existing roads, existing sidewalks, existing paving, existing curbs, and other features indicated on Drawings to remain, or not indicated to be removed, from damage and displacement. If damaged or displaced, notify Engineer and correct defects as directed.
2. Protect above and below grade utilities which are to remain.

B. Preparation:

1. Use all means necessary to control dust on and near the work, and on and near off-site storage, and spoil areas, if such dust is caused by performance of the work of this Section, or if resulting from the condition in which Project Site is left by Contractor.
2. Moisten surfaces, as required, to prevent dust from being a nuisance to the public, neighbors, and concurrent performance of other work on Project Site.

C. Install erosion control systems at the site's boundary at locations where stormwater runoff will leave the site prior to starting any clearing, stripping, or earthwork operations

D. Minimize the time areas are to be exposed without vegetative cover.

E. Properly dispose of solid waste, paints, solvents, cleaning compounds, etc.

F. Store construction materials in designated areas away from drainageways and low areas.

G. Provide portable toilets and properly dispose of sanitary sewage.

H. Construct containment berms and utilize drip pans at fuel and liquid storage tanks and containers.

3.2 Installation Of Erosion Control Devices

A. Install erosion control devices to protect adjacent and downstream properties from damage and pollution resulting from erosion caused by the work of this Contract.

1. Implement erosion control measures indicated on drawings and additional erosion control measures necessary to prevent damage to adjacent and downstream properties.

B. Install silt fence located along perimeter of site or grading limits immediately following site clearing operations specified under Division 31 Section 31 11 00 Clearing and Grubbing.

1. Install silt fence fabric from a continuous roll for the length of the silt fence whenever possible to minimize the number of joints.

- a. Create joints in fabric by securely fastening fabric at the support post with overlap extending to the next post.
2. Drive support post into ground not less than 18 inches.
3. Excavate a 4-inch-wide by 4-inch-deep trench on up-slope side of silt fence.
 - a. Line trench with silt fence fabric material.
 - b. Backfill trench with soil or gravel.
- C. Install straw bale fence at completion of grading operations in affected area as indicated on drawings.
 1. Install erosion control devices at storm sewer inlets immediately after completion of the storm sewer.
 2. Place straw bales in a single row, lengthwise on the contour, and embedded 4 inches into soil.
 3. Secure each individual bale in place by stakes or reinforcement bars driven through bales into the ground to a depth of not less than 18 inches.
- D. Install inlet protection barriers at curb inlets and at area inlets.
- E. Install straw bale fences as ditch checks in drainage ditches.
- F. Install Stabilized Construction Access per TxDOT specification 506.4.C.5.
- G. Rock filter dams shall be installed so as to prevent downstream deposition of sediment and debris from the construction site. Rock filter dams shall be constructed to meet the following criteria:
 1. Type 1:
 - a. Non-reinforced.
 - b. Height: 18-24 inches
 - c. Top width: 2 feet minimum.
 - d. Upstream and downstream side slope of dam: 2:1 maximum.
 - e. Open graded aggregate 3-5 inches.
 2. Type 2:
 - a. Reinforced with wire mesh.
 - b. Height: 18-36 inches.
 - c. Top width: 2 feet minimum.

- d. Upstream and downstream side slope of dam: 2:1 maximum.
 - e. Open graded aggregate 3-5 inches.
 3. Type 3:
 - a. Reinforced with wire mesh.
 - b. Height: 36-48 inches.
 - c. Top width: 2 feet minimum.
 - d. Upstream and downstream side slope of dam: 3:1 maximum.
 - e. Open graded aggregate 4-8 inches.
 4. Type 4:
 - a. Reinforced in a gabion wire basket.
 - b. Height: 30 inches minimum.
 - c. Top width: 2 feet minimum.
 - d. Upstream and downstream side slopes of dam: none specified.
 - e. Open graded aggregate 3-5 inches.
5. The separation geotextile fabric and wire mesh shall be sized and placed in accordance with the rock filter dam detail and as specified by the type of rock filter dam shown in the construction plans. The separation geotextile fabric may be omitted only as approved by the Engineer. The separation geotextile fabric and wire mesh shall be securely staked with wooden or metal stakes to the bottom and side slopes of the ditch or channel prior to aggregate placement. Sack gabions for Type 4 rock filter dams shall be securely staked with wooden or metal stakes to the bottom and side slopes of the ditch or channel, as well.
6. Aggregate fill shall be placed to the width, length, height and slopes in accordance with this specification and the rock filter dam detail and as specified by the type of rock filter dam shown in the construction plans. The height of the dam shall be measured vertically from the existing ground to the top of the filter dam. The length of the dam shall be measured across the top centerline of the dam from embankment to embankment and includes the additional length embedded into the embankment. Width of the dam shall be measured along the top face of the dam.
7. Wire mesh shall be folded upstream side over the aggregate fill and tightly secured to itself on the downstream side using wire ties. Hog rings may be

substituted for wire ties.

8. Additional aggregate fill or gravel bags shall be placed and secured at the embedded section to prevent low flows from short circuiting the dam at the adjacent dirt embankment area.
9. The Contractor shall be responsible for periodic reshaping, repairing, and maintaining of rock filter dams as directed by the Engineer.
10. The Contractor is responsible for removal and proper disposal of sediment and debris from the rock filter dam. Removed sediment and debris shall not be allowed to flush into the storm sewer system, waterways, jurisdictional wetlands, or onto adjacent properties. Sediment deposits shall be removed before they reach one-third of the height of the dam. Uncontaminated sediment can be placed at the project spoil site or, if properly handled, spread out to supplement fill requirements. If sediment has been contaminated, then it shall be disposed of in accordance with the applicable federal, state, and local regulations. Offsite disposal shall be the responsibility of the Contractor. Contractor is encouraged to reuse aggregate and wire mesh if remaining materials meet original spec requirements.

3.3 Erosion Control Seeding

- A. Exposed fill and stockpile areas shall be protected from windborne erosion if the phasing of the construction operations is anticipated to leave the exposed fill and stockpile areas unattended for 6 weeks or more. At completion of stockpiling operations, stockpiles shall be shaped and graded to drain. Provide a layer of mulch to all sides of the stockpile to protect the stockpile from windborne erosion.
- B. Areas designated on the drawings to be seeded shall be seeded in accordance to the Texas Department of Transportation Standard Specifications, Item 164, titled "Seeding for Erosion Control". Broadcast seeding method shall be used as described in TxDOT, Item 164.4 unless otherwise instructed.
- C. Areas to be seeded with slopes steeper than 10H:1V shall also utilize a soil retention blanket as specified in TxDOT Item 169 Soil Retention Blanket.

3.4 Temporary Swales

- A. Temporary drainage swales shall be provided as required to carry drainage away from the work area to an approved outfall point.
- B. Unless otherwise shown on the drawings, swales shall be earthen "V" shaped channels graded to a sufficient depth and slope to carry the anticipated runoff, but at least two (2) feet deep with a slope of 0.1%.
- C. Swales not designated to remain in place at the completion of the contract shall be cleaned of any muck, debris and other unsuitable material and filled with approved fill before final grading operations begin.
- D. Swales shall have erosion control barriers as required in these specifications.

3.5 Fill And Cut Slopes

- A. Fill slopes in all cases shall be no steeper than 3:1 unless specifically stated on the plans or approved by the Owner's Geotechnical engineer.
- B. When cut slopes exceed 2:1 for depths over three (3) feet, proper bracing and shoring per OSHA requirements shall be used and maintained.
- C. For permanent slopes, cut or fill, between 2:1 and 10:1, erosion protection shall be provided with hydromulching seeding, sodding, or other method as approved.
- D. Where cut slopes of more than 5 feet deep, extend more than 100 feet in length, contractor shall provide a backfill drain at the top of the slope to ease in drainage and erosion control.

3.6 Sedimentation Basins

- A. Sedimentation ponds shall be provided when designated on the plans.
- B. All drainage from cleared areas shall be routed through the sedimentation basin.
- C. Contractor will be responsible for the operation and maintenance of the pond during construction.

3.7 Maintenance

- A. Check all erosion control measures after each rainfall event to ensure that they are in proper working order.
 - 1. Immediately restore all measures to installed condition.
 - 2. During the course of construction all temporary swales constructed for this contract shall be maintained so as to allow proper drainage from the construction area. Before Contractor leaves the site at the end of construction, all temporary swales must be reworked to meet final conditions as set forth in the drawings and specifications.
 - 3. The Contractor shall assure that all subwork with other contractors at the site understand the importance of the erosion control features. The Contractor shall require all subcontractors to respect the function of the erosion control features and enlist their coordination in maintaining existing swales and ditches.
- B. Inspect silt and straw bale fences at least once a week.
 - 1. Immediately replace damaged portions of the silt fences, including portions which have collapsed, contain tears, have decomposed, or have become ineffective.
 - 2. Remove sediment deposits, as necessary, to provide adequate sediment storage and to maintain the integrity of fences. Dispose of accumulated sediment by spreading over upland areas of the site.
- C. Maintain erosion control devices in place, as specified, until completion of the work of this Contract.

1. At completion of work, inspect all systems, make necessary repairs, remove and dispose of all accumulated sediment, and turn completely operable systems over to Owner for continued maintenance.
- D. Where necessary for equipment and vehicular access to the work areas, adequately sized culverts shall be installed and maintained to provide the access without disturbing the site drainage.
- E. Sedimentation Basins.
1. Contractor shall be responsible for maintaining the pond and the outfall and sediment retarding structure in good working condition throughout the time the pond is to be in operation.
 2. When sediment and debris fill the pond to over one third (1/3) its designed capacity, the pond shall be cleaned out.
 3. The sediment from the clearing operation shall be stockpiled with like materials per Specification 31 11 00 Clearing and Grubbing. If the material is found to not meet the stockpiling requirements listed in 31 11 00, they must be removed from the site as described in 31 11 00.

3.8 Inspections

- A. Inspect all erosion control systems and devices at least once every seven calendar days.
- B. Inspect all erosion control systems and devices within 24 hours of the end of any storm which results in precipitation of 1/2 inch or more.
- C. During inspections, locations where stormwater leaves the site shall be inspected for evidence of erosion or sediment deposition.
- D. Correct deficiencies within three calendar days.
- E. Complete a report of each inspection. Report shall contain the following minimum information:
 1. Inspector's name
 2. Inspection date
 3. Observations of the effectiveness of erosion control systems
 4. Actions taken if necessary to correct deficiencies
 5. Listing of areas where construction operations have permanently or temporarily stopped
 6. Authorized signature

END OF SECTION

**SECTION 31 3116
TERMITE CONTROL**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Chemical soil treatment.

1.02 REFERENCE STANDARDS

- A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act; 2019.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.
- C. Test Reports: Indicate regulatory agency approval reports when required.
- D. Manufacturer's Certificate: Certify that toxicants meet or exceed specified requirements.
- E. Certificate of compliance from authority having jurisdiction indicating approval of toxicants.
- F. Manufacturer's Application Instructions: Indicate caution requirements and materials list of proposed items to be provided under this section.
- G. Record and document moisture content of soil before application, date and rate of application, areas of application, and diary of toxicity meter readings and corresponding soil coverage.
- H. Installer Qualifications: Company specializing in performing work of the type specified and with minimum 5 years years of documented experience.
- I. Maintenance Data: Indicate re-treatment schedule .
- J. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing this type of work and:
 - 1. Having minimum of 5 years documented experience.
 - 2. Approved by manufacturer of treatment materials.
 - 3. Licensed in Texas.

1.05 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year installer's warranty against damage to building caused by termites.
 - 1. Include coverage for repairs to building and to contents damaged due to building damage. Repair damage and, if required, re-treat.
 - 2. Inspect annually and report in writing to Owner. Provide inspection service for 5 years from Date of Substantial Completion.
 - 3. Make inspections, retreatment, and repairs at no additional cost to the Owner.

PART 2 PRODUCTS

2.01 CHEMICAL SOIL TREATMENT

- A. Installer shall notify the Texas Department of Agriculture no more than 24 hours before application and provide all data and pre-treatment paperwork to the Owner for review.
 - 1. Form TDA Q527 must be completed to satisfy state documentation requirements and presented to the IPM Coordinator.
- B. Toxicant Chemical: EPA Title 7, United States Code, 136 through 136y approved; synthetically color dyed to permit visual identification of treated soil.

- C. Diluent: Recommended by toxicant manufacturer.
- D. Manufacturers:
 - 1. Taurus SC by Control Solutions, Inc: www.controlsolutionsinc.com.
 - 2. Termiticide/Termidor SC by Termidor Termite Defense: www.termidorhome.com
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- E. Mixes: Mix toxicant to manufacturer's instructions.
- F. If combinations of toxicants are approved by governmental agencies having jurisdiction, provide toxicants having such approval and in the maximum strength so approved, at no additional cost to the Owner.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.
- B. Verify final grading is complete.

3.02 APPLICATION - CHEMICAL TREATMENT

- A. Comply with requirements of U.S. EPA and applicable state and local codes.
- B. Spray apply toxicant in accordance with manufacturer's instructions.
- C. Apply toxicant at following locations:
 - 1. Under Slabs-on-Grade.
 - 2. In Crawl Spaces.
 - 3. At Interior Side of Foundation Surface.
 - 4. Utility Entrances
 - 5. Immediately below expansion joints, control joints, and all areas where slab will be penetrated by construction features.
 - 6. Where exterior facings or veneers extend below grade level along the exterior side of all foundation walls.
 - 7. Where unit masonry foundation construction is used.
 - 8. Extend treatment to 5'-0" outside of building perimeter.
- D. Under slabs, apply toxicant immediately prior to installation of vapor barrier or void forms.
- E. At foundation walls, apply toxicant immediately prior to finish grading work outside foundations.
- F. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.
- G. Re-treat disturbed treated soil with same toxicant as original treatment.
- H. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

3.03 PROTECTION

- A. Do not permit soil grading over treated work.

END OF SECTION

**SECTION 31 6329
DRILLED CONCRETE PIERS AND SHAFTS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Dry-installed drilled piers.
 - 2. Slurry displacement-installed drilled piers.
 - 3. Dry-installed or slurry displacement-installed drilled piers at Contractor's choice.

1.3 UNIT PRICES

- A. Unit prices are included in Section 01 2200 "Unit Prices."
- B. Drilled Piers: Actual net volume of drilled piers in place and approved. Actual length, shaft diameter, and bell diameter if applicable, may vary, to coincide with elevations where satisfactory bearing strata are encountered. These dimensions may also vary with actual bearing value of bearing strata determined by an independent testing and inspecting agency. Adjustments will be made on net variation of total quantities, based on design dimensions for shafts and bells.
 - 1. Base bids on indicated number of drilled piers and, for each pier, the design length from top elevation to bottom of shaft, extended through the bell, if applicable, and the diameter of shaft and bell.
 - 2. Unit prices include labor, materials, tools, equipment, and incidentals required for excavation, trimming, shoring, casings, dewatering, reinforcement, concrete fill, testing and inspecting, and other items for complete drilled-pier installation.
- C. Trial Drilled Pier: Unit price as indicated for drilled pier, including backfilling.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.

- C. Shop Drawings: For concrete reinforcement detailing fabricating, bending, supporting, and placing.
- D. Material Certificates: For the following, from manufacturer:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Steel reinforcement and accessories.
- E. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
- F. Field quality-control reports.
- G. Other Informational Submittals:
 - 1. Record drawings.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer that has specialized in drilled-pier work.
- B. Testing Agency Qualifications: Qualified according to ASTM C 1077, ASTM D 3740, and ASTM E 329 for testing indicated.
- C. Drilled-Pier Standard: Comply with ACI 336.1 unless modified in this Section.

1.6 PROJECT CONDITIONS

- A. Existing Utilities: Locate existing underground utilities before excavating drilled piers. If utilities are to remain in place, provide protection from damage during drilled-pier operations.
 - 1. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, adapt drilling procedure if necessary to prevent damage to utilities. Cooperate with Owner and utility companies in keeping services and facilities in operation without interruption. Repair damaged utilities to satisfaction of utility owner.
- B. Interruption of Existing Utilities: Do not interrupt any utility to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
 - 1. Notify all affected parties including Owner no fewer than five (5) days in advance of proposed interruption of utility.
 - 2. Do not proceed with interruption of utility without Owner's written permission.
- C. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.
 - 1. Make additional test borings and conduct other exploratory operations necessary for drilled piers.
 - 2. The geotechnical report is referenced elsewhere in the Project Manual.

- D. Survey Work: Engage a qualified land surveyor or professional engineer to perform surveys, layouts, and measurements for drilled piers. Before excavating, lay out each drilled pier to lines and levels required. Record actual measurements of each drilled pier's location, shaft diameter, bottom and top elevations, deviations from specified tolerances, and other specified data.
1. Record and maintain information pertinent to each drilled pier and cooperate with Owner's testing and inspecting agency to provide data for required reports.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Refer Section 03 20 00.

2.2 CONCRETE MATERIALS

- A. Refer Section 03 3000 and Structural General Notes.

2.3 STEEL CASINGS

- A. Steel Pipe Casings: ASTM A 283, Grade C, or ASTM A 36, carbon-steel plate, with joints full-penetration welded according to AWS D1.1.
- B. Corrugated-Steel Pipe Casings: ASTM A 929, steel sheet, zinc coated.

2.4 SLURRY

- A. Slurry: Pulverized bentonite, pulverized attapulgite or polymers mixed with water to form stable colloidal suspension; complying with ACI 336.1 for density, viscosity, sand content, and pH

2.5 CONCRETE MIXTURES

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement according to ACI 301 limits as if concrete were exposed to deicing chemicals.
- C. Proportion normal-weight concrete mixture as follows:
1. As indicated in Structural General Notes.

2.6 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.7 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, vibration, and other hazards created by drilled-pier operations.

3.2 EXCAVATION

- A. Unclassified Excavation: Excavate to bearing elevations regardless of character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions.
 - 1. Obstructions: Unclassified excavation may include removal of unanticipated boulders, concrete, masonry, or other subsurface obstructions. No changes in the Contract Sum or the Contract Time will be authorized for removal of obstructions.
 - 2. Obstructions: Unclassified excavated materials may include removal of unanticipated boulders, concrete, masonry, or other subsurface obstructions. Payment for removing obstructions that cannot be removed by conventional augers fitted with soil or rock teeth, drilling buckets, or underreaming tools attached to drilling equipment of size, power, torque, and downthrust necessary for the Work will be according to Contract provisions for changes in the Work.
- B. Prevent surface water from entering excavated shafts. Conduct water to site drainage facilities.
- C. Excavate shafts for drilled piers to indicated elevations. Remove loose material from bottom of excavation.
 - 1. Excavate bottom of drilled piers to level plane within 1:12 tolerance.
 - 2. Remove water from excavated shafts before concreting.
- D. Notify and allow testing and inspecting agency to test and inspect bottom of excavation. If unsuitable bearing stratum is encountered, make adjustments to drilled piers as determined by Architect.
 - 1. Do not excavate shafts deeper than elevations indicated unless approved by Architect.
 - 2. Payment for additional authorized excavation will be according to Contract provisions for changes in the Work.
- E. Excavate shafts for closely spaced drilled piers and for drilled piers occurring in fragile or sand strata only after adjacent drilled piers are filled with concrete and allowed to set.

- F. Slurry Displacement Method: Stabilize excavation with slurry maintained a minimum of *60 inches* above ground-water level and above unstable soil strata to prevent caving or sloughing of shaft. Maintain slurry properties before concreting.
- G. Temporary Casings: Install watertight steel casings of sufficient length and thickness to prevent water seepage into shaft; to withstand compressive, displacement, and withdrawal stresses; and to maintain stability of shaft walls.
 - 1. Remove temporary casings, maintained in plumb position, during concrete placement and before initial set of concrete.
- H. Bells: Excavate bells for drilled piers to shape, base thickness, and slope angle indicated. Excavate bottom of bells to level plane and remove loose material before placing concrete.
- I. Tolerances: Construct drilled piers to remain within ACI 336.1 tolerances.
 - 1. If location or out-of-plumb tolerances are exceeded, provide corrective construction. Submit design and construction proposals to Architect for review before proceeding.

3.3 STEEL REINFORCEMENT

- A. Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy bond with concrete.
- C. Fabricate and install reinforcing cages symmetrically about axis of shafts in a single unit.
- D. Accurately position, support, and secure reinforcement against displacement during concreting. Maintain minimum cover over reinforcement.
- E. Use templates to set anchor bolts, leveling plates, and other accessories furnished in work of other Sections. Provide blocking and holding devices to maintain required position during final concrete placement.
- F. Protect exposed ends of extended reinforcement, dowels, or anchor bolts from mechanical damage and exposure to weather.

3.4 CONCRETE PLACEMENT

- A. Place concrete in continuous operation and without segregation immediately after inspection and approval of shaft by Owner's independent testing and inspecting agency.
 - 1. Construct a construction joint if concrete placement is delayed more than one hour. Level top surface of concrete. Before placing remainder of concrete, clean surface laitance, roughen, and slush concrete with commercial bonding agent or with sand-cement grout mixed at ratio of 1:1.
- B. Dry Method: Place concrete to fall vertically down the center of drilled pier without striking sides of shaft or steel reinforcement.
 - 1. Where concrete cannot be directed down shaft without striking reinforcement, place concrete with chutes, tremies, or pumps.

2. Vibrate top 60 inches of concrete.
- C. Slurry Displacement Method: Place concrete in slurry-filled shafts by tremie methods or pumping. Control placement operations to ensure that tremie or pump pipe is embedded no fewer than *60 inches* into concrete and that flow of concrete is continuous from bottom to top of drilled pier.
- D. Coordinate withdrawal of temporary casings with concrete placement to maintain at least a 60-inch head of concrete above bottom of casing.
 1. Vibrate top 60 inches of concrete after withdrawal of temporary casing.
- E. Screed concrete at cutoff elevation level and apply scoured, rough finish. Where cutoff elevation is above the ground elevation, form top section above grade and extend shaft to required elevation.
- F. Protect concrete work, according to ACI 301, from frost, freezing, or low temperatures that could cause physical damage or reduced strength.
 1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 2. Do not use calcium chloride, salt, or other mineral-containing antifreeze agents or chemical accelerators.
- G. If hot-weather conditions exist that would seriously impair quality and strength of concrete, place concrete according to ACI 301 to maintain delivered temperature of concrete at no more than 90 deg F.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 1. Drilled piers.
 2. Excavation.
 3. Concrete.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Drilled-Pier Tests and Inspections: For each drilled pier, before concrete placement.
 1. Soil Testing: Bottom elevations, bearing capacities, and lengths of drilled piers indicated have been estimated from available soil data. Actual elevations and drilled-pier lengths and bearing capacities will be determined by testing and inspecting agency. Final evaluations and approval of data will be determined by Architect.
- D. Concrete Tests and Inspections: ASTM C 172 except modified for slump to comply with ASTM C 94.
 1. Slump: ASTM C 143; one test at point of placement for each compressive-strength test but no fewer than one test for each concrete load.
 2. Concrete Temperature: ASTM C 1064; 1 test hourly when air temperature is 40 deg F and below and 80 deg F and above, and 1 test for each set of compressive-strength specimens.
 3. Compression Test Specimens: ASTM C 31; one set of four standard 6-inch x 12-inch cylinders for each compressive-strength test unless otherwise indicated. Mold and store

- cylinders for laboratory-cured test specimens unless field-cured test specimens are required.
4. Compressive-Strength Tests: ASTM C 39; one set for each drilled pier but not more than one set for each truck load. One specimen will be tested at 7 days, 2 specimens will be tested at 28 days, and 1 specimen will be retained in reserve for later testing if required.
 5. If frequency of testing will provide fewer than five strength tests for a given class of concrete, testing will be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 6. If strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
 8. Report test results in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. List Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests in reports of compressive-strength tests.
 9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 10. Additional Tests: Testing and inspecting agency will make additional tests of concrete if test results indicate that slump, compressive strengths, or other requirements have not been met, as directed by Architect.
 - a. Continuous coring of drilled piers may be required, at Contractor's expense, if temporary casings have not been withdrawn within specified time limits or if observations of placement operations indicate deficient concrete quality, presence of voids, segregation, or other possible defects.
 11. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.
 12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- E. An excavation, concrete, or a drilled pier will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports for each drilled pier as follows:
1. Actual top and bottom elevations.
 2. Actual drilled-pier diameter at top, bottom, and bell.
 3. Top of rock elevation.
 4. Description of soil materials.
 5. Description, location, and dimensions of obstructions.
 6. Final top centerline location and deviations from requirements.
 7. Variation of shaft from plumb.
 8. Shaft excavating method.
 9. Design and tested bearing capacity of bottom.
 10. Levelness of bottom and adequacy of cleanout.
 11. Properties of slurry and slurry test results at time of slurry placement and at time of concrete placement.

12. Ground-water conditions and water-infiltration rate, depth, and pumping.
13. Description, purpose, length, wall thickness, diameter, tip, and top and bottom elevations of temporary or permanent casings. Include anchorage and sealing methods used and condition and weather tightness of splices if any.
14. Description of soil or water movement, sidewall stability, loss of ground, and means of control.
15. Bell dimensions and variations from original design.
16. Date and time of starting and completing excavation.
17. Inspection report.
18. Condition of reinforcing steel and splices.
19. Position of reinforcing steel.
20. Concrete placing method, including elevation of consolidation and delays.
21. Elevation of concrete during removal of casings.
22. Locations of construction joints.
23. Concrete volume.
24. Concrete testing results.
25. Remarks, unusual conditions encountered, and deviations from requirements.

3.6 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

**SECTION 32 1313
PORTLAND CEMENT CONCRETE PAVING**

PART 1 - GENERAL

1.1 Description

- A. This Section specifies the requirements for providing, placing, curing and protecting Portland cement concrete paving, with or without reinforcement as indicated, constructed on a prepared sub-grade.

1.2 Quality Assurance

A. Reference Standards Applicable to this Section

1. ACI: American Concrete Institute

- a. 301: Specifications for Structural Concrete for Buildings.
- b. 316R: Recommendations for Construction of Concrete Pavements and Concrete Bases.

2. ASTM: American Society for Testing and Materials

- a. A 615: Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement (with Supplement + S1).
- b. C 150: Specification for Portland Cement Type I or Type II.
- c. C 309: Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- d. C 881: Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
- e. D 1565: Specifications for Flexible Cellular Materials Vinyl Chloride Polymers and Copolymers (Open-Cell Foam).
- f. D 1751: Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient bituminous Types).
- g. D 1752: Specifications for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
- h. D 3405: Specification for Joint Sealants, Hot-Poured, for Portland Cement Concrete Pavement.

3. TxDOT: Texas Department of Transportation.

- a. Standard Specifications for Construction of Highways, Streets, and Bridges -- Latest Edition.
 - 1) Item 360, CONCRETE PAVEMENT.

B. Formwork Tolerances

- Formwork tolerances shall be as specified in ACI 316 R, Chapter 5.
- C. Finishing Tolerance

The top surface of pavement shall have a Class B tolerance as specified in ACI 316 R, Chapter 12.5 and ACI 301, Chapter 11.9.

- D. The Portland Cement Paving Contractor/Subcontractor shall provide COM with evidence of his/her ability to perform the specified work. This evidence shall be in the form of at least five (5) successfully completed Portland Cement paving projects for either the COM, Jefferson County, City of Beaumont or any combination of the three.

This list of projects shall be submitted to COM prior to any paving operations beginning so that COM will be able to inspect the quality of workmanship at the site and approve the Contractor/Subcontractor.

1.3 Submittals

- A. In accordance with Section 00 72 00 – Uniform General Conditions, Sub-Section UGC 8.3 for Texas State University System (TSUS) projects, the following shall be submitted:

1. Reinforcement Materials

- a. As required in Section 032100 - Concrete Reinforcement of these Specifications.

2. Concrete Materials

- a. As required in Sections 321373.19 - Cast-in-Place Concrete of these Specifications.

3. Joint Materials

- a. As required in Section 321319 – Concrete Pavement Joints.

1.4 Extended Warranty

- A. Manufacturer of joint sealant shall provide at least a 1-year written warranty against material degradation or failure and water and foreign matter infiltration through the joint from the time of written acceptance of the Work. This warranty shall not limit COM's rights or remedies as may otherwise be afforded under law or statute.

PART 2 – PRODUCTS

2.1 Materials

A. Forms

Metal forms, as indicated in ACI 316 R, Chapter 5.

B. Welded Steel Wire Fabric

Plain wire fabric, as specified in Section 032100 - Concrete Reinforcement of these Specifications.

C. Reinforcing Steel Bars

As specified in Section 032100 - Concrete Reinforcement of these Specifications.

D. Dowel Bars

Smooth, ASTM A 615 + S1, Grade 60, new billet steel, coated with a water-resistant lubricant immediately prior to placement of concrete in which unbonded ends of bars are to be embedded.

E. Dowel Bar Sleeves

Sleeves, PVC or plastic, slightly larger than dowel bars, closed end, a minimum of 6 in. long, with 1-1/2 in. long compressible insert.

F. Concrete

Class 3000, as specified in Section 321373.19 – Cast-in-Place Concrete of these Specifications.

G. Membrane Forming Curing Compound

ASTM C 309, Type 2, unless otherwise directed.

H. Joint Materials

1. Preformed Expansion Joint Filler: ASTM D 1751, ASTM D 1752, and D 1565.
2. Joint Sealing Material: See Section 321319, Concrete Pavement Joints of these Specifications.

I. Form Coating

Commercial formulation form-coating compounds that will neither bond with, stain, nor adversely affect concrete surfaces and will not impair subsequent treatment of concrete surfaces. Contractor shall submit sample for approval prior to use.

J. Precast Concrete Wheel Stops

Accurately formed and finished, of size and shape as indicated, reinforced and anchored as required. Fabricate wheel stops on Site or substitute approved precast units of like design and dimensions.

K. Epoxy Bonding Grout

ASTM C 881, Type I.

PART 3 – EXECUTION

3.1 Inspection and Preparation

- A. Prepared subgrade shall be proof rolled to check for unstable areas and need for additional compaction. Do not begin paving work until such deficiencies have been corrected and subgrade is ready to receive paving.
- B. Loose material shall be removed from the compacted subgrade immediately prior to placing concrete and subgrade shall be uniformly dampened.

3.2 Setting Forms

- A. Forms shall be set in accordance with the recommendations of ACI 316 R, Chapter 5, and as specified herein.
- B. Forms shall be set in sufficient quantity to allow continuous progress of concrete placement, and to ensure that forms shall remain in place not less than 24 hours.
- C. Forms shall be cleaned after each use and coated with an approved form release agent prior to each use.

3.3 Installation of Joints, Reinforcement, and Sealant

- A. Joints and reinforcement shall be installed in accordance with the recommendations of ACI 316 R, Chapter 6, as specified in Section 032100 - Concrete Reinforcement of these Specifications, and in Section 321319 - Concrete Pavement Joints.
- B. Sealant manufacturer's instructions and procedures shall be followed so as not to invalidate the warranty.

3.4 Placing and Finishing Concrete

- A. Concrete shall be placed and finished in accordance with the recommendations of ACI 316 R, Chapters 10 and 12.5, and as specified in Section 033053 - Cast-in-Place Concrete of these Specifications.

3.5 Curing and Protecting Concrete

- A. Concrete shall be cured in accordance with the recommendations of ACI 316 R, Chapter 11, using the membrane curing method and materials.
- B. Protection as recommended in ACI 316 R; Chapter 11 shall be provided until written acceptance by COM.

3.6 Installation of Concrete Wheel Stops

- A. Install concrete wheel stops where indicated and in accordance with manufacturer's installation instructions as required. Where dowels are to be embedded into concrete, embed with epoxy bonding grout.

3.7 Field Quality Control

A. Coring

After the pavement is placed and before final acceptance the Engineer may elect to determine pavement thickness by cores cut from the pavement or direct measurement of the edge thickness. Acceptable pavement thickness shall be deficient by no more than two tenths of an inch. Core holes shall be promptly repaired with concrete conforming to the requirements specified herein by the Contractor at no cost to COM.

B. Deficient Pavement Price Adjustments

Where the average thickness of pavement is deficient in thickness by more than 0.2 inch, but not more than 0.75-inch, payment will be made at an adjusted price as specified in the following table.

Concrete Pavement Deficiency

Deficiency in Thickness Determined by Cores Inches	Proportional Part of Contract Price Allowed
0.00 to 0.20	100 percent
Over 0.20 to 0.30	80 percent
Over 0.30 to 0.40	72 percent
Over 0.40 to 0.50	68 percent
Over 0.50 to 0.75	57 percent

Any area of pavement found deficient in thickness by more than 0.75 of an inch but not more than one inch or 1/8 of the plan thickness, whichever is greater, shall be evaluated by the Engineer. If, in the judgment of the Engineer, the area of such deficiency should not be removed and replaced, there will be no payment for the area retained. If, in the judgment of the Engineer, the area of such deficiency warrants removal, the area shall be removed and replaced, at the Contractor's entire expense, with concrete of the thickness shown on the plans. Deficient pavement shall be removed for the full area of the slab between joints, or between pre-established limits.

END OF SECTION

**SECTION 32 1319
CONCRETE PAVEMENT JOINTS**

PART 1 - GENERAL

- 1.01 Section Includes
- A. Joints for concrete paving; concrete sidewalks, concrete driveways, curbs, and curb and gutters.
 - B. Saw-cutting existing concrete or asphalt pavements for new joints.
- 1.02 Measurement And Payment
- A. Unit Prices.
 - 1. Payment for street pavement expansion joints, with or without load transfer, is on linear foot basis.
 - 2. Payment for horizontal dowels is on a unit price basis for each horizontal dowel.
 - 3. No separate payment will be made for formed or sawed street pavement contraction joints and longitudinal weakened plane joints. Include payment in unit price for Concrete Paving.
 - 4. No separate payment will be made for joints for Curb, Curb and Gutter, Saw-tooth Curb, Concrete Sidewalks, and Concrete Driveways. Include payment in unit price for Curb and Gutter, Concrete Sidewalks, and Concrete Driveways.
 - 5. Payment will be made for Preformed Expansion Joints on a linear foot basis only when field conditions require that sidewalk be moved adjacent to existing concrete structure (i.e., street, back of curb, etc.).
 - 6. Refer to Section 01270 - Measurement and Payment for unit price procedures.
 - B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.
- 1.03 References
- A. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.ASTM D 994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
 - B. ASTM D 1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - C. ASTM D 3405 - Standard Specification for Joint Sealants,

Hot-Applied, for Concrete and Asphalt Pavements.

D. TxDOT Tex-525-C - Tests for Asphalt and Concrete Joint Sealers

1.04 Submittals

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Submit product data for joint sealing compound and proposed sealing equipment for approval.
- C. Submit samples of dowel cup, metal supports, and deformed metal strip for approval. Submit manufacturer's recommendation for placing sealant(s).

PART 2 - PRODUCTS

2.01 Board Expansion Joint Material

- A. Filler board of selected stock. Use wood of density and type as follows:
 - 1. Clear, all-heart cypress weighing no more than 40 pounds per cubic foot, after being oven dried to constant weight.
 - 2. Clear, all-heart redwood weighing no more than 30 pounds per cubic foot, after being oven dried to constant weight.

2.02 Preformed Expansion Joint Material

- A. Bituminous fiber and bituminous mastic composition material conforming to ASTM D 994 and ASTM D 1751.

2.03 Joint Sealing Compound

- A. Conform joint sealants to one of sealant classes described in this section.
- B. Conform hot-poured rubber-asphalt compound to ASTM D 3405.
- C. Two-component Synthetic Polymer.
 - 1. Curing is to be by polymerization and not by evaporation of solvent or fluxing of harder particles.
 - 2. Cure sufficiently at average temperature of 25 ± 1 C (77 ± 2 F) so as not to pick up under wheels of traffic in maximum three hours.

3. Performance requirements, when tested in accordance with TxDOT Tex- 525-C, shall meet above curing times and requirements as follows:

Cold-Extruded and Cold-Pourable (Self-Leveling) Specifications	
Property	Requirement
Penetration, 25 C (77 F) 150 g Cone, 5 s, 0.1 mm (in.), maximum	130
Bond and Extension 50%, -29 C (-20 F), 3 cycles: *Dry Concrete Block *Steel blocks (Primed, if recommended by manufacturer) *Steel blocks shall be used when armor joints are specified	Pass Pass
Flow at 70 C (158 F)	None
Water content % by mass, maximum	5.0
Resilience: * Original sample, % min. (cured) * Oven-aged at 70 C (158 F), % min.	50 50
Cold-extruded material only - Cold Flow (10 minutes)	None

After bond and extension test, there shall be no evidence of cracking, separation or other opening that is over 3 millimeters (1/8 inch) deep in sealer or between sealer and test blocks.

4. Provide cold-extruded type for vertical or sloping joints.
 5. Provide self-leveling type for horizontal joints.
- D. Self-Leveling, Low Modulus Silicone or Polyurethane Sealant for Asphaltic Concrete and Portland Cement Concrete Joints. This shall be a single component self-leveling silicone or polyurethane material that is compatible with both asphalt and concrete pavements. The sealer shall not require a primer for bond; a backer rod shall be required which is compatible with the sealant; no reaction shall occur between rod and sealant.

When tested in accordance with TxDOT Tex-525-C, self-leveling sealant shall meet following requirements:

Self-Leveling, Low Modulus Silicone or Polyurethane Sealant	
Property	Requirements
Tack Free Time, 25 ± 1 C (77 ± 2 F), minutes	120 maximum
Nonvolatile content, % by mass	93 minimum
Tensile Strength and 24-Hour Extension Test: * Initial, 10-day cure, 25 ± 1 C (77 ± 2 F), kPa (psi) * After Water Immersion, kPa (psi) * After Heat Aging, kPa (psi) * After Cycling, -29 C (-20 F), 50%, 3 cycles, kPa (psi) * 24 Hour Extension	* 21 to 69 (3 to 10) * 21 to 69 (3 to 10) * 21 to 69 (3 to 10) * 21 to 69 (3 to 10) * Pass (All Specimens) After 24 hours, there shall be no evidence of cracking, separation or other opening that is over 3 mm (1/8 in.) deep at any point in the sealer or between the sealer and test blocks.

2.04 Load Transmission Devices

- A. Smooth, steel dowel bars conforming to ASTM A 615, Grade 60. When indicated on Drawings, encase one end of dowel bar in approved cap having inside diameter 1/16 inch greater than diameter of dowel bar.
- B. Deformed steel tie bars conforming to ASTM A 615, Grade 60.

2.05 Supports for Reinforcing Steel and Joint Assembly

- A. Employ supports of approved shape and size that will secure reinforcing steel and joint assembly in correct position during placing and finishing of concrete. Space supports as directed by Project Manager.

PART 3 - EXECUTION

3.01 Placement

- A. When new Work is adjacent to existing concrete, place joints at same location as existing joints in adjacent pavement.
- B. If limit of removal of existing concrete or asphalt pavement does not fall on existing joint, saw cut existing pavement minimum of 2 inches deep to provide straight, smooth joint surface without chipping, spalling or cracks.

3.02 Construction Joints

- A. Place transverse construction joint wherever concrete placement must be stopped for more than 30 minutes. Place longitudinal construction joints at interior edges of pavement lanes using No. 6 deformed tie bars, 30 inches long and spaced 18 inches on centers.

3.03 Expansion Joints

- A. Place 3/4-inch expansion joints at radius points of curb returns for cross street intersections, or as located in adjacent pavement but no further than 80 feet apart. Use no boards shorter than 6 feet. When pavement is 24 feet or narrower, use not more than 2 lengths of board. Secure pieces to form straight joint. Shape board filler accurately to cross section of concrete slab. Use load transmission devices of type and size shown on Drawings unless otherwise specified or shown as "No Load Transfer Device." Seal with joint sealing compound.

3.04 Contraction Joints

- A. Place contraction joints at same locations as in adjacent pavement or at spaces indicated on Drawings. Place smoothed, painted and oiled dowels accurately and normal to joint. Seal groove with joint sealing compound.

3.05 Longitudinal Weakened Plane Joints

- A. Place longitudinal weakened plane joints at spaces indicated on Drawings. If more than 15 feet in width is poured, longitudinal joint must be saw cut. Seal groove with joint sealing compound.

3.06 Sawed Joints

- A. Use sawed joints as alternate to contraction and weakened plane joints. Use circular cutter capable of cutting straight line groove minimum of 1/4 inch wide. Maintain depth of one quarter of pavement thickness. Commence sawing as soon as concrete has hardened sufficiently to permit cutting without chipping, spalling or tearing and prior to initiation of cracks. Once sawing has commenced, continue until completed. Make saw cut with one pass. Complete sawing within 24 hours of concrete placement. Saw joints at required spacing consecutively in sequence of concrete placement.
- B. Concrete Saw: Provide sawing equipment adequate in power to complete sawing to required dimensions and within required time. Maintain ample supply of saw blades at work site during sawing operations. Maintain sawing equipment on job during concrete placement.

3.07 Joints for Curb, Curb and Gutter

- A. Place 3/4-inch preformed expansion joints through curb and gutters at locations of expansion and contraction joints in pavement, at end of radius returns at street intersections and driveways, and at curb inlets. Maximum spacing shall be 120- foot centers.

3.08 Joints for Concrete Sidewalks

- A. Provide 3/4-inch expansion joints conforming to ASTM A 1751 along and across sidewalk at back of curbs, at intersections with driveways, steps, and walls; and across walk at intervals not to exceed 36 feet. Provide expansion joint material conforming to ASTM D 994 for small radius curves and around fire hydrants and utility poles. Extend expansion joint material full depth of slab.

3.9 Joints for Concrete Driveways

- A. Provide 3/4-inch expansion joints conforming to ASTM D 1751 across driveway in line with street face of sidewalks, at existing concrete driveways, and along intersections with sidewalks and other structures. Extend expansion joint material full depth of slab.

3.10 Joint Sealing

- A. Seal joints only when surface and joints are dry, ambient temperature is above 50 degrees F and less than 85 degrees F and weather is not foggy or rainy.
- B. Use joint sealing equipment in like new working condition throughout joint sealing operation and be approved by Project Manager. Use concrete grooving machine or power-operated wire brush and other equipment such as plow, brooms, brushes, blowers or hydro or abrasive cleaning as required to produce satisfactory joints.
- C. Clean joints of loose scale, dirt, dust and curing compound. The term joint includes wide joint spaces, expansion joints, dummy groove joints or cracks, either preformed or natural. Remove loose material from concrete surfaces adjacent to joints.
- D. Fill joints neatly with joint sealer to depth shown. Pour sufficient joint sealer into joints so that, upon completion, surface of sealer within joint will be 1/4 inch above level of adjacent surface or at elevation as directed.

3.11 Protection

- A. Maintain joints in good condition until completion of Work.
- B. Replace damaged joints material with new material as required by this Section.

END OF SECTION

SECTION 32 1373.19
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 Description

- A. This Section includes furnishing materials and installation of cast-in-place concrete as indicated on the Drawings and/or specified herein.
- B. Full cooperation shall be given to other trades to install embedded items. Suitable templates insert and sleeves shall be provided for setting items not placed in the forms.
- C. All concrete work shall conform to the requirements of ACI 318-95 and CRSI Standards, unless specifically noted otherwise.

1.02 Quality Assurance

- A. Prior to starting concrete operations, the Contractor shall name his source of supply for concrete materials and shall submit representative samples and reports of quality tests for approval.
- B. The Contractor will engage the services of a recognized independent testing laboratory, approved by the Owner, to perform the following services, (in accordance with ASTM E 329-77) the cost of which shall be paid by the Contractor:
 - 1. Design the concrete mixtures specified, make quality tests of materials, inspect the proportioning and mixing of all concrete for this project.
 - 2. Slump Test, ASTM C-143, shall be taken as often as required to provide the specified consistency to concrete.
 - 3. Cast and test of at least 6 cylinders for each day's pour or for each 100 cubic yards or fraction thereof. Cylinders shall be cured and tested in accordance with ASTM specifications for control tests. Cylinders shall be tested at 7 and 28 days. The Contractor shall provide insulated storage room with heat when necessary to store control cylinders, and a protected, fenced-in space for storage of field cylinders, which approximates the condition of curing of the concrete being sampled.
- C. In the event that concrete fails to meet strength requirements of these Specifications, the Engineer may require at no additional cost to the Owner, tests in accordance with the "Standard Methods of Securing, Preparing and Testing Specimens of Hardened Concrete for Compressive and Flexural Strengths", ASTM C42, or order load tests in accordance with Chapter 20 of the ACI Building Code 318-95, to be made on the portions of the structure containing questionable concrete. Suitable appliances and methods of loading and measuring shall be provided by the Contractor. The portions of the structure which are found by the Architect/Engineer to contain defective concrete shall be removed and reconstructed in a satisfactory manner at the Contractor's expense. Concrete strength tests are to conform to Chapter 4 of the ACI Building Code 318-95.
- D. The laboratory shall have free access to material stockpiles, batching and mixing plants, and job site. The Contractor shall provide adequate assistance to the laboratory in securing specified samples for tests.

E. Contractor shall give the Owner and laboratory reasonable notice before beginning any pours (at least 24 hours).

The laboratory shall supply a daily report of concrete and materials testing and inspection to the Architect, Engineer, Design/Builder, Contractor and Owner.

F. Concrete batched away from the job and delivered in mixer or agitator trucks shall conform to requirements of ASTM C94.

G. Authority and Duties of Laboratory Personnel:

Inspectors shall inspect the materials and the manufacture of concrete as specified and shall report to the Owner's Representative, Contractor, Architect and the Engineer the progress thereof. Also, when it appears that the material furnished and the work performed by the Contractor fail to fulfill the specification requirements and contract, the inspector shall direct the attention of the Contractor to such failure or infringement. Such inspection shall not relieve the Contractor of any obligation to furnish acceptable materials or to provide the concrete quality in the structure that is in strict accord with plans and specifications. The inspector are not authorized to revoke, alter, relax, enlarge, or release any portion of the work, but in case of any dispute arising between the inspector and the Contractor as to materials furnished or in the manner of performing the work the inspector shall have the authority to reject materials or suspend the work until the question at issue can be referred to the Engineer. The inspector shall not act as foreman or perform other duties for the Contractor. In no case shall any advice or omission on the part of the inspector relieve the Contractor of responsibility for completing the work in accordance with the plans and specifications and the fulfillment of the contract. The work will be inspected as it progresses, but failure to reject any defective work or materials shall not in any way prevent later rejection when such defect is discovered or obligate the Engineer for final acceptance. Any expense incidental to the investigation and determination of actual quality of any questionable material shall be borne by the Contractor.

H. Sampling and Testing:

1. All materials shall be sampled, tested in accordance with appropriate ASTM Standards, and approved before inclusion in any work on this project.
2. Samples for testing shall be furnished by the Contractor.
3. Rejected material shall be immediately removed from the site.
4. Reinforcing steel shall be tested by heat in shops and by random sampling in the field when required by the Architect/Engineer or Owner.

1.03 Submittals

A. Shop Drawings: The Contractor is to include as a part of his expense the cost of completely dimensioned concrete shop drawings embracing plans and details, bending diagrams, steel order list, placing diagrams, which service shall be furnished by a structural engineer licensed in the State of the project. No portion of the contract documents shall be reproduced and submitted as shop drawings. The shop drawings shall include the following:

1. Foundation Plan – fully dimensioned, foundation schedule and details, wall sections, mechanical pad details, and related miscellaneous details. All details plans and sections shall show reinforcing.
2. Pier Details and Pier Schedule.
3. Wall Elevations – fully dimensioned showing all thicknesses, reinforcing sections, form joints and all items that will leave visible marks or interruptions in the finished surfaces.
4. Necessary Floor Plans – fully dimensioned plans with all depressions, rises, reinforcing steel, to include placement and accessories.

5. Miscellaneous Items – All other reinforced concrete items shall be drawn at such scale as to give full dimensions, details and reinforcing with accessories as required.
- B. All reinforcing shall be detailed, ordered, and fabricated in accordance with the latest ACI Manual of Standard Practice for Detailing Concrete Structures and the CRSI Manual of Standard Practice.
- C. Submit Shop Drawings to the Architect for review, prior to release to field. Fabrication of reinforcing steel shall not be started until Drawings have been reviewed and stamped.
- D. Prior to the placement of any concrete, design mixes for each type of concrete shall be submitted and approved by the testing laboratory. Mix designs shall include all required and shall include each type of aggregate and admixture to be used.

1.04 Product Delivery, Storage and Handling

- A. Concreting shall not be started during rain, sleet or snow and shall not be continued during such weather after having been started except long enough to come to a suitable cutoff point. Concrete placed during rain shall have the cement content increased in the amount of one sack of cement per cubic yard of concrete. All forms and earth forms shall be free of ice and frozen surfaces.
- B. No concrete shall be poured unless temperature is 40 degrees and rising or unless special precautions are taken (approved by the Architect). Adequate equipment shall be provided for heating the concrete materials and protecting the concrete during freezing and near freezing weather. All concrete shall have a temperature of between 50 degrees and 90 degrees F when depositing, and shall be maintained within this temperature range for at least 72 hours or for as much time as is required to insure the proper rate of curing. No salt or other chemicals shall be added to prevent freezing. The covering or other method used for temperature protection shall remain in place 24 hours after artificial heat is discontinued. The recommended Practice for Cold Weather Concreting (ACI 306) and the “Recommended Practice for Hot Weather Concreting” (ACI 305) shall be accepted as good practice.

PART 2 - PRODUCTS

2.01 Materials

- A. All materials shall be subject to approval. Any change of materials specified shall be submitted for approval and such change, if acceptable, shall be used only when specifically authorized in writing.
- B. Cement shall conform to the following specifications:
 1. Coarse and fine aggregate shall conform to requirements of ASTM C33 or Federal Specification SS-S-281a.
 2. All coarse aggregates shall be crushed limestone.
 3. The maximum size of coarse aggregate shall not be larger than 1", 1/5 of the narrowest dimension between forms of the member for which the concrete is to be used, nor larger than 3/4 the minimum clear spacing between reinforcing bars. Coarse aggregate for all concrete exposed to the weather shall be crushed limestone with a #57 gradation.
 4. Absorption in coarse aggregate shall not exceed 5%.
 5. The fineness modulus for fine aggregate used shall not vary more than 0.2 from the approved sample without approval. Fineness modulus to be 2.9.
- C. All concrete shall be normal weight unless specifically noted otherwise.

1. Normal weight concrete shall be approximately 145 to 155 pounds per cubic foot.

2. Lightweight concrete shall not exceed 110 pounds per cubic foot and shall be made of normal and normal weight fines.
- D. Water shall be clean, fresh, and free from injurious amounts of oils, acids, alkali or organic material or other substances that may be deleterious to concrete or steel.
- E. Non-shrink grout shall be factory pre-mixed non-shrink, non-metallic grout containing mineral aggregate and shall require only the addition of water at the site. Grout shall be “EUCO NS” (non-metallic) as manufactured by the Euclid chemical company. “Masterflow 713” (non-metallic) as manufactured by Master Builders or approved equal. The grout shall conform to ASTM C-1107 and CRD-621, “Corps of Engineers Specifications for Non-Shrink Grout,” and shall be tested in accordance with ASTM C827.
- F. Waterstops shall be 9” Dumbbell type, Model No. 751 as manufactured by Greenstreak, at locations shown on drawings.

2.02 Quality And Proportioning

- A. It shall be the Contractor’s responsibility to furnish concrete which will conform to the quality and strength specified.
- B. Strengths, unless otherwise indicated on plans or in specifications or in the table below, shall be 3000 psi minimum 28 day compressive strength.

1. Columns	4000psi
2. Slabs above ground floor	3000psi
3. Concrete Beams	4000psi
4. Footing and Piers	3000psi
5. Pilasters, Walls	4000psi
6. Slabs on Grade	4000psi
7. Tilt Panels	4000psi
8. Exterior Concrete	4000psi (5% Air Entrained)

- C. Proportioning shall follow the limiting factors in the following table:

	Concrete Class	
	3000#	4000#
1. Minimum allowable compressive strength at 28 days (psi)	3000	4000
2. Maximum allowable water per sack of cement: (gal/sack):		
a. Non-air entrained:	6-1/2	5-1/2
b. Air entrained:	5-1/4	5
3. Slump, range in inches:	3-5	3-5
4. Minimum sacks of cement per cu. yd.	5-1/4	6-1/4
5. Water reducing agent oz./100# cement:	3	3
6. Proportioning on the basis of field experience shall conform to Section 5.3 of ACI 318-89 or the maximum water/cement ratio in Section 5.4 of ACI 318-89.		

- D. Design mixes shall be established to produce average strengths higher than specified by the amounts specified in Chapter 5 of ACI 318-95.

E. Admixtures:

1. Calcium Chloride shall not be used.
2. An approved air-entraining agent (ASTM C260) shall be added at the mixer with accurate dispenser to produce entrained air 4-6% by volume in all concrete subject to weathering conditions.
3. An approved water-reducing agent equal to those manufactured by mixer with an accurate dispenser.
4. These and other admixtures shall be used only with specific approval. Tests for design mixes shall be made with the admixtures included.
5. Fly ash shall not be permitted.

F. The concrete shall be of such consistency and composition that it can be worked readily into the corners and angles of the forms and around reinforcement without permitting materials to segregate or free water to collect on the surfaces. Within the limiting requirements the Contractor shall adjust the consistency of the concrete as may be necessary to produce mixtures which will be placeable with reasonable methods of placing and compacting. The Contractor shall maintain on the job at all times adequate extra cement to be used at the rate of $\frac{1}{2}$ sack cement per cubic yard concrete for each 2" slump increase for corrections due to wetness desired or obtained. No water shall be added to concrete except under the direct supervision of the engineer or his appointed representative. Under no circumstances will the addition of more than 2 gallons of water per cubic yard of concrete be allowed at the site.

G. Measurement of Materials:

1. Cement shall be measured by the sack or half-sack unless cement is weighed for each batch.
2. Aggregates shall be proportioned separately by weight with proper compensation for weight of moisture; weighing equipment shall be accurate within 1%.
3. Water shall be measured by an approved device capable of accurate measurement to one pint.

H. Concrete shall be from a single source for each major pour.

2.03 Forms

A. Refer to Section 03100 for requirements for concrete forms.

2.04 Reinforcement

A. Refer to Section 03200 for requirements for reinforcement.

2.05 Expansion Materials

- A. Verify compatibility of joint filler with sealant specified.
- B. All expansion joints on grade shall be pre-formed non-extruding resilient type, bituminous or bonded cork (ASTM D994 or ASTM D1751).
- C. Other expansion joints may comply with ASTM D1752 – “Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.”
Manufacturer’s certification and material submittal are required.

2.06 Curing, Sealing And Hardening Compounds

A. Liquid Curing and Sealing Compounds – General requirements

- 1. Curing Compounds: Comply with ASTM C 309, Type 1, Class B.
 - a. Non-yellowing formulation where subject to ultra violet light.
 - b. Curing and Sealing Compound: Where indicated, providing curing and sealing formulation with long-lasting finish that is resistant to chemicals, oil, grease, deicing salts, and abrasion.
- 2. Curing and Hardening Compound: Free of waxes, resins or oils; meet water retention requirements of ASTM C 309; penetrate concrete to change free lime to calcium silicate forming a permanently dense, hard surface.
- 3. The curing compound shall have test data from an independent laboratory indicating a maximum moisture loss of 0.030 grams per square cm. When applied at a coverage rate of 300 square feet per gallon. Manufacturer’s certification is required.
 - a. Provide L&M “dress & Seal 30” or Master Builders “Masterseal 66.”
 - b. Dissipating Resin Curing Compound: The compound shall be a dissipating resin type compound, conforming to ASTM C309, Type I, “Kurez DR” by The Euclid Chemical Company or approved equal. The film must chemically break down in a two to four week period after application.
- 4. Curing compounds shall not be used on any surface against which additional concrete or other cementitious material are to be bonded.

2.07 Vapor Retarders (Barriers)

An approved vapor barrier shall be placed as called for in the Contract Documents. Supply a vapor barrier that complies with one of the following:

- A. ASTM E 1745, Class A: A three-ply, nylon- or polyester-cord reinforced, high-density polyethylene sheet; laminated to a nonwoven geotextile fabric, 30 mils (0.76 mm) thick.
- B. ASTM E 1745, Class B: A five-ply nylon- or polyester cord-reinforced, high-density polyethylene sheet; 10 mils (0.25 mm) thick.
- C. ASTM E 1745, Class C: One of the following materials, or polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick:
 - 1. Nonwoven, polyester-reinforced, polyethylene coated sheet; 10 mils (0.25 mm) thick.
 - 2. Three-ply, nylon- or polyester-cord-reinforced, laminated, high-density polyethylene sheet; 7.8 mils (0.18 mm) thick.
- D. Submittal is required.

PART 3 - EXECUTION

3.01 Inspection

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the proper and timely completion of the Work. Do not proceed until satisfactory conditions have been corrected.

3.02 Conduits, Hangers, Supports, Anchors, Etc.

- A. The Contractor shall see that all necessary bolts and anchors of all other trades employed on this structure including conduits, sockets, inserts, sleeves, etc., will be placed by their respective trades or shall himself place them to details before concreting a given section of work. He shall see that these items do not interfere with the reinforcement.
- B. No aluminum conduit or product containing aluminum or any other material detrimental to concrete shall be embedded in concrete.
- C. All openings in slabs, beams, columns, and footings, which are not shown on the structural plans, must be approved by the Engineer. The maximum diameter of embedded pipes or conduit shall be 1/3 times the slab or wall thickness. The minimum center-to-center spacing of embedded pipes or conduits shall be three times the outside diameter. For pipes or conduits of different diameters, the minimum edge-to-edge spacing shall be two times the smaller diameter.
- D. All pipes and conduits providing flow able material conveyance which penetrate beams, footings, or walls shall be provided with sleeves of an appropriate size and material to provide movement for expected settlements or deflections.

3.03 Preparation

- A. Concrete placing shall not be started until all necessary preparations have been completed and approval has been given. Preparations shall consist of completing all form work involved, placing all reinforcing steel, pipes, conduits, sleeves, hangers, anchors, fastening devices, waterproofing and such other work to be built into the concrete in the section to be poured, and any other preparations herein required for the concreting operations. Free water and any mud or debris shall be removed from forms and excavations to be occupied by concrete. Approved equipment shall be available on the job site for heating and/or protecting the concrete whenever freezing temperatures are likely to occur within the curing period. Ice or chilled water may be required to control concrete temperature in hot weather to below 90 degrees F.
- B. Slabs-on-grade shall be placed on a properly leveled and thoroughly compacted sub grade, equal to 93% maximum dry density. All subsoil's for slabs shall be approved before placing concrete.
- C. Approved equipment shall be provided for heating concrete materials and/or protecting the concrete whenever freezing temperatures are likely to occur within curing period.

3.04 Installation

- A. Concrete shall be conveyed from the mixer or transporting vehicle to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of materials or displacement of the reinforcing steel and which will avoid rehandling. For ready-mix concrete in an agitator truck, the elapsed time from mixer to placement shall not exceed 1-1/2 hours.
- B. Concrete shall be deposited as nearly as practicable in its final position and shall have the qualities required. Concrete shall be deposited continuously in layers or sections of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause seams or planes of weakness. If sections cannot be placed continuously, proper construction joints shall be provided.
- C. Concrete during and immediately after depositing shall be thoroughly compacted and worked around reinforcing and embedded fixtures and into all parts of forms by means of spades, rods and approved mechanical vibrators.
For thin walls or inaccessible portions, concrete shall be worked into place by vibrating or other approved method: Care shall be taken so as not to work concrete to the point where segregation occurs.

3.05 Construction And Control Joints

- A. All horizontal and vertical construction joints shall be intentionally roughened to a full $\frac{1}{4}$ " \pm amplitude or have a continuous 2"x 4" keyway along the joint at contractor's option.
- B. Provide reinforcing dowels to match the member reinforcing at the joint, unless noted otherwise.
- C. Unless indicated otherwise, slabs-on-grade shall have construction or control joints spaced not to exceed 30 times the slab thickness in any direction. All discontinuous control or construction joints shall be reinforced with two (2) #4 x 48". See structural details. Construction joints shall not exceed a distance of 15'-0" O.C. in any direction.

- D. Control joints shall be installed in slabs-on-grade so the length-to-width ratio of the slab is not more than 1.25:1. Control joints shall be completed within 12 hours of concrete placement. Control joints may be installed by:
1. Saw Cut to a depth of $\frac{1}{4}$ the thickness of the slab.
 2. Tooled joints shall be made to a depth of $\frac{1}{4}$ the thickness of the slab.
- E. Control joints in visually exposed walls, unless noted otherwise (shall line up with masonry and architectural joints, see drawings):
1. Vertical control joints at 10'-0" O.C.
 2. Reinforcing shall be continuous through control and construction joints, unless noted otherwise.
 3. Control joints in foundation walls shall line up with masonry control joints.
- F. Control joints shall be installed in suspended slabs over steel decking by saw cutting along all interior grid lines. Joints centered above the purlins shall be $\frac{3}{4}$ " deep and shall have #4x5'-0" at 16" O.C. reinforcing placed perpendicular to (and centered on) the purlin. Joints centered above the girders shall be $\frac{3}{4}$ " deep and shall have #4x16'0" O.C. reinforcing placed perpendicular to (and centered on) the girder. The #4 bar reinforcing centered above the grid lines shall be in addition to the specified WWF,
which is continuous throughout the suspended slabs over steel decking. Reinforcing shall be placed 1" below the top of the slab.

3.06 Finishing

- A. Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding $\frac{1}{4}$ " in height rubbed down or chipped off.
- B. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or surfaces that are covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp proofing, painting or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.
- C. Smooth Rubbed Finish: Provide smooth rubbed finish to scheduled concrete surfaces, which have received smooth form finish treatment, not later than one day after form removal. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.
- E. Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, terrazzo, stone and other bonded applied cementitious finish flooring material, and as otherwise indicated. After placing slabs, plane surface to a tolerance not exceeding

½" in 10' when tested with a 10' straightedge. Slope surfaces uniformly to drains where required. After leveling; roughen surface before final set, with stiff brushes, brooms or rakes.

- F. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, and as otherwise indicated. After screening, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Check and level surface plane to a tolerance not exceeding ¼" in 10' when tested with a 10' straightedge. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth granular texture.
- G. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, paint or other thin film finish coating system. After floating, begin final trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8" in 10' when tested with a 10' straightedge. Grind smooth surface defects, which would telegraph through applied floor covering system.
- H. Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated. Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect and Owner's Representative before application. See Section 02528 – Concrete Paving and Curbs.
- I. Chemical-Hardener Finish: Apply chemical-hardener finish to interior concrete floors where indicated. Apply liquid chemical-hardener after complete curing and drying of the concrete surface. Dilute liquid hardener with water, and apply in 3 coats; first coat, 1/3-strength; second coat, ½-strength; third coat, 2/3-strength. Evenly apply each coat and allow 24 hours for drying between coats. Apply proprietary chemical hardeners, in accordance with manufacturer's printed instructions. After final coat of chemicalhardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

3.07 Concrete Surface Repairs

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Architect. Cut out honeycomb, rock pockets, voids over ¼" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water and brushcoat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.
- B. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
- C. Repair of Formed Surfaces: Remove and replace concrete having defective surface if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning. Flush out form

tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.

- D. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.
- E. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having required slope.
- F. Repair finished unformed surfaces that contain defects, which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.
- G. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.
- H. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Architect.
- I Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least ¾" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same material to provide concrete of same type or class as original concrete. Place, compact and finish to blend with adjacent finish concrete. Cure in same manner as adjacent concrete.
- J. Repair isolated random cracks and single holes not over 1" in diameter by dry-pack method. Groove top of cracks and cut-out holes to sound concrete and clean of dust, dirt and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry pack, consisting of one-part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding compound has dried. Compact-dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours. Use epoxy-based mortar for structural repairs, where directed by the testing laboratory.
- K. Repair methods not specified above may be used, subject to acceptance of Architect.

3.08 Concrete Curing And Protection

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting; keep continuously moist for not less than 7 days. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.
- B. Curing Methods: Perform curing of concrete by moist curing, by moisture-retaining cover curing, by curing compound, and by combinations thereof, as herein specified.

C. Provide moisture curing by following methods:

1. Keep concrete surface continuously wet by covering with water.
2. Continuous water-fog spray.
3. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

D. Provide moisture-cover as follows:

1. Cover concrete surfaces with moisture retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

E. Provide curing compound to slabs as follows:

1. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
2. Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, damp proofing, membrane roofing, flooring, painting, and other coatings and finish materials, unless otherwise acceptable to Architect.

F. Curing Formed Surfaces: Cure formed concrete surfaces, by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

G. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of appropriate curing compound. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

3.09 Miscellaneous

A. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

END OF SECTION

**SECTION 32 1613
CONCRETE CURBS AND CURB & GUTTER**

PART 1 – GENERAL

1.1 Description

- A. This Section specifies the requirements for providing, placing, curing, and protecting Portland cement concrete curbs, and combination curbs and gutters, constructed on a prepared sub-grade.

1.2 Quality Assurance

A. Reference Standards Applicable to this Section

1. ACI: American Concrete Institute
 - a. 316R: Recommendations for Construction of Concrete Pavements and Concrete Bases.
2. ASTM: American Society for Testing and Materials
 - a. A 615: Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement (with Supplement + S1).
 - b. C 150: Specification for Portland Cement Type I or Type II.
 - c. C 309: Specification for Liquid Membrane - Forming Compounds for Curing Concrete.
 - d. D 1565: Specifications for Flexible Cellular Materials Vinyl Chloride Polymers and Copolymers (Closed Cell).
 - e. D 1751: Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient bituminous Types).
 - f. D 1752: Specifications for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
 - g. D 3405: Specification for Joint Sealants, Hot-Poured, for Portland Cement Concrete Pavement.
3. FS: Federal Specifications and Standards
 - a. TT-P-86: Paint, Red-Lead-Base, Ready-Mixed.

B. Finishing Tolerance

The top surface of curbs and combination curbs and gutters shall have a Class A tolerance as specified in ACI 316 R, Chapter 12.5.

1.3 Submittals

A. In accordance with Section 00 72 00 – Uniform General Conditions, Sub-Section UGC 8.3 for Texas State University System (TSUS) projects, the following shall be submitted:

1. Reinforcement Materials

a. As required in Section 032100 - Concrete Reinforcement of these Specifications.

2. Concrete Materials

a. As required in Sections 321373.19 - Cast-in-Place Concrete of these Specifications.

1.4 Extended Warranty

A. Manufacturer of joint sealant shall provide at least a 1-year written warranty against material degradation and failure and water and foreign matter infiltration through the joint from the time of written acceptance of the Work. This warranty shall not limit LIT rights or remedies as may otherwise be afforded under law or statute.

PART 2 - PRODUCTS

2.1 Materials

A. Forms

Either wood or metal, of the size and shape necessary for forming the item, straight and free of warp.

B. Reinforcing Steel Bars

As specified in Section 032100 - Concrete Reinforcement of these Specifications.

C. Dowel Bars

Smooth, ASTM A 615 + S1, Grade 60, new billet steel, unbonded ends painted with red-lead-base paint, FS TT-P-86, Type I and coated with a water-resistant lubricant immediately prior to placement of concrete in which unbonded ends of bars are to be embedded.

D. Dowel Bar Expansion Caps

PVC or plastic cap, slightly larger than dowel bar, closed end, a minimum of 6 in. long, with 1-1/2 in. long compressible insert.

E. Concrete

Class 3000, as specified in Section 321373.19 – Cast-in-Place Concrete of these Specifications.

F. Membrane Forming Curing Compound

ASTM C 309, Type 2, unless otherwise directed.

G. Joint Materials

1. Preformed Expansion Joint Filler: Nonextruding and resilient bituminous type, ASTM D 1751.
2. Joint Sealing Material: See Section 321373 of these Specifications.

H. Form Coating

Commercial formulation form-coating compound that will not bond with, stain nor adversely affect concrete surfaces and will not impair subsequent treatment of concrete surfaces.

PART 3 - EXECUTION

3.1 Inspection and Preparation

- A. Prepared subgrade shall be inspected for unstable or unsuitable areas and need for additional compaction. Notify the Engineer in writing of such deficiencies. Do not begin curb construction until all such deficiencies have been corrected.
- B. Loose and foreign material shall be removed from the compacted subgrade immediately prior to placing concrete, and subgrade shall be uniformly dampened.

3.2 Setting Forms

- A. Forms shall be set to the line and grade indicated and shall be securely staked to maintain set position during depositing and curing of concrete. The inside form shall be rigidly attached to the outside form.
- B. Forms shall be set in sufficient quantity to allow continuous progress of concrete placement and to ensure that forms shall remain in place not less than 24 hours.
- C. Forms shall be cleaned after each use and coated with an approved form release agent prior to each use.

3.3 Installation of Joints, Reinforcement, and Sealant

- A. Reinforcement shall be installed as indicated on the Drawings and as specified in Section 032100 - Concrete Reinforcement of these Specifications. Joints shall be installed where indicated on the Drawings and in accordance with Section 321319 – Concrete Pavement Joints of these Specifications.
- B. Sealant manufacturer's instructions and procedures shall be followed so as not to invalidate the warranty.

3.4 Placing And Finishing Concrete

- A. Concrete shall be placed and finished as specified in Section 033053 - Cast-in-Place Concrete of these Specifications, and ACI 316 R, Chapters 10 and 12.5.
- B. After concrete has been struck off and has sufficiently set, the exposed surfaces shall be worked with a wood float. The exposed edges shall be rounded using an edging tool.

- C. After form removal, the surfaces of the curb or combination curb and gutter shall be plastered with a mortar consisting of one-part Portland Cement and two parts fine aggregate. Mortar shall be applied with a template constructed to the shape and dimensions of the item to be plastered. All exposed surfaces shall be brushed to a uniform smooth texture.
- 3.5 Curing And Protecting Concrete
- A. Concrete shall be cured in accordance with the recommendations of ACI 316 R, Chapter 11, using the membrane curing method and materials.
 - B. Protection as recommended in ACI 316 R; Chapter 11 shall be provided until written acceptance by the Engineer.

END OF SECTION

**SECTION 32 1828
TENNIS COURTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Design, engineering and construction of post-tensioned concrete tennis courts.
- B. Tennis court related fencing and gates.
- C. Wind screens.
- D. Nets, posts and hardware.
- E. Surfacing and court markings.
- F. Court lighting.
- G. The "Work" of this Section is defined to include, but not necessarily to be limited to:
 - 1. Requirements indicated are to establish a minimum standard. Provide tennis court work to meet these standards, but in no case less than those required by the Tennis Court Design Engineer.
 - 2. The scope of this work shall be the construction of the Tennis Courts as on the site plans as a complete and whole construction package including, but not be limited to, the engineered design of the Tennis Courts concrete slab and foundation, and fencing. Further, the scope of work shall include, but not be limited to the furnishing and installation or construction of the Tennis Courts including the concrete footings, concrete slab, reinforcing, pad preparation as recommended by the geotechnical report, all soil stabilization below and five feet outside the perimeter of the slab, fencing, nets, posts, and windscreens. In addition to the court, provide lighting Poles, fixtures, all necessary wiring, electrical panels, transformers, timers, and electrical service to the Tennis Courts from the nearest power service.
 - 3. Tennis Courts shall comply with the latest U.I.L. rules and regulation and be constructed to comply with United States Tennis Association (USTA) Specifications.
 - 4. Entire system including but not limited to, courts, fencing, equipment and lighting along with any other accessory items, shall be designed as a performance specification. A Professional Engineer licensed in the State of Texas shall seal the court designs submitted.
 - 5. A full copy of the geotechnical report has been included in the project manual.

1.02 RELATED REQUIREMENTS

- A. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 01 of these Specifications.
- B. Section 00 3132 - Geotechnical Data.
- C. Section 03 3000 - Cast-In-Place Concrete.
- D. Section 03 3800 - Post-Tensioned Concrete.
- E. Section 26 5668 - Tennis Court Lighting

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting two weeks prior to the start of the work of this section; require attendance by all affected installers.
- B. Coordination: Coordinate the installation of court lighting with size, location and installation of service utilities.
- C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product data: Within 15 calendar days after the Contractor has received the Owner's Notice to Proceed, submit the following:
 - 1. Materials list of items proposed to be provided under this Section, and related Sections;
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements; including color samples.
 - 3. Shop drawings requirements for submission to the local AHJ for permitting.
- C. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.
- D. Shop Drawings:
 - 1. Submit sealed design documents and calculations for for submission to the local AHJ for permitting requirements and A/E review.
 - a. Foundation Design
 - b. Dimensioned court layouts
 - c. Equipment locations.
 - d. Fencing calculations and layouts
 - e. Striping width and color.
 - f. Proposed colored graphic or logo.
 - 2. Shop drawing sheets that include engineering information designed by the Contractor's Delegated Design Engineer shall be signed and sealed in accordance with the Texas Engineering Practice Act. Sheets that do not provide information designed by the Contractor's Engineer do not require being signed and sealed. Calculation packages require a signed and sealed cover sheet only. Any submittals requiring to be signed and sealed that are received without the signature and seal will be rejected without review.
 - 3. Submit a copy of the latest U.I.L. rules and regulations verifying compliance.
- E. Samples: Accompanying the submittal described above, submit Samples of each sealant, each backing material, each primer, and each bond breaker proposed to be used.

1.05 QUALITY ASSURANCE

- A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in Texas.
- B. Tennis Court Contractor shall have completed at least ten (10) similar size tennis court projects in the last three years.
- C. Surfacing applicator shall have a minimum of one hundred (100) tennis court applications of proven experience.
- D. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- E. Submission of Substitute Materials:
 - 1. If other than the product specified, submit at least five working days prior to the bid date a complete type written list of all such proposed substitutions together with sufficient data, drawings, samples, literature, and other detailed information as will demonstrate to the satisfaction of the Owner that the proposed substitute material is equal in quality and utility to that originally specified. Under no circumstances will a surfacing system comprised of several products produced or manufactured from different sources be considered.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 6000 - Product Requirements, for transportation, handling, storage and protection procedures.
- B. Do not use material which has exceeded the shelf life recommended by its manufacturer.

1.07 FIELD CONDITIONS

- A. Ambient Conditions: Do not install materials when environmental conditions are outside of the acceptable ranges recommended by the manufacturer.
- B. Weather Limitations: No part of the construction involving the surfacing system may be conducted during rain or when rain is imminent. The air and surface temperature must be at least 50 deg. F. and rising. Do not apply when surface temperature is above 140 deg. F.
- C. Existing Conditions: See subsurface investigation report; see Section 00 3132.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide three year manufacturer warranty for windscreens.
- C. System Warranty:
 - 1. Provide a written guarantee warranting the entire system, including all materials, devices, and workmanship to be free of defects for a period of five (5) years from the date of completion, unless otherwise indicated. Any defects in materials, devices, and workmanship which become apparent within the guarantee period shall be repaired or replaced by the contractor at his own expense, and at no additional cost to the Owner.

PART 2 PRODUCTS AND EXECUTION

2.01 GENERAL

- A. The materials and installation of foundations, synthetic surfaces, fences, equipment for tennis courts and tennis court lighting indicated are a part of these specifications are minimum standards but shall be in no case less than those required by the Design Engineer.

2.02 TENNIS COURT POST-TENSIONED SLAB

- A. See Section 03 3800 - Post-Tensioned Concrete.

2.03 TENNIS COURT LIGHTING

- A. See Division 26 - Tennis Court Lighting

2.04 TENNIS COURT COLOR SURFACING

- A. Manufacturers:
 - 1. California Products Corp.; Plexipave System: www.plexipave.com.
 - 2. Hellas Construction; Model TPS 5000: www.hellasconstruction.com
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Materials:
 - 1. Patching Mix (California Court Patch Binder) - for use in patching cracks, holes, depressions and other surface imperfections.
 - 2. Crack Filler (Plexipave Crack Filler) - for use in filling fine cracks.
 - 3. Concrete Preparer - specially formulated acid heat for use in neutralizing the concrete in preparation for the Plexipave System.
 - 4. Adhesion Primer - (California TiCoat) - two component water based epoxy primer for uncoated concrete surfaces.
 - 5. Acrylic Filler Course (California Acrylic Resurfacer) - for use as a filler for new or existing concrete surfaces. The 100% acrylic filler shall be blended with approved silica sand at the job site.

6. Acrylic Color Playing Surface (Plexichrome/Plexipave Color Base) - for use as the finish color and texture. Plexichrome and Plexipave Color Base are blended at the job site to achieve the correct surface texture. Factory Fortified Plexipave may be used as an alternative material.
7. Line Paint (California Line Paint) - for use as the line marking on the court/play surface.
8. Water: - for use in dilution/mixing shall be clean and potable.

2.05 TENNIS COURT CHAIN LINK FENCING

- A. Height
 1. Height of fence shall be 10' - 0".
 - B. Fabric
 1. Nine gauge (9 Ga.) black resin clad fabric shall have a polyvinyl chloride coating, minimum wall thickness of .015 inches over a galvanized substrate. The base metal shall have a minimum breaking strength of five hundred fifty pounds (550 lbs.) and a zinc coat weight of .1503 pounds per square foot of uncoated wire surface. Top and bottom salvage of the fabric shall be knuckled with one and three-quarters inch (1 $\frac{3}{4}$ " mesh).
 - C. Pipe and Accessories
 1. Method of Manufacturing: Pipe used for fence framework shall be cold rolled and electric-resistance-welded from steel conforming to ASTM A-569 and hot dip galvanized to ASTM A-525 G-90 zinc weight both inside and outside the pipe. The outside then receives a conversion coating and fusion bonded black polyester powder coating. The application of the coating will consist of three (3.0) mils of cured thermosetting polyester powder coatings applied over zinc phosphate pretreatment of galvanized steel.
 2. Posts: All line, and gateposts shall be two and seven-eighths inch outside diameter (2 $\frac{7}{8}$ " O.D.) with a wall thickness of eleven gauge (11 Ga.) and a minimum yield strength of fifty-five thousand pounds per square inch (55,000 psi). Corner posts shall be 4" pipe, outside diameter, 9.1 lbs. per ft.
 3. Rails: Shall be one and five-eighths inch outside diameter (1 $\frac{5}{8}$ " O.D.) pipe with a wall thickness of thirteen gauge (13 Ga.) and a minimum yield strength of fifty five thousand pounds per square inch (55,000 psi) and provided with seven inch (7") long expansion sleeve couplings. Provide top, middle and bottom rails.
 4. Accessories:
 - a. Fabric Ties: Eleven gauge (11 Ga.) galvanized steel tie wire to fasten fabric to framework. Tension wire shall be attached to fabric bottom with heavy galvanized hog rings.
 - b. Tension Wire: Two (2) strands of twelve and half gauge (12.5 Ga.) steel wire twisted together.
 - c. Tension Bands: Beveled edge type with nuts and bolts.
 - d. Line Post Tops: Heavy galvanized cast from eye top fitting.
 - e. Terminal Post Tops: Heavy galvanized iron tops of bullet type construction.
 - f. Coating: All accessories to receive black polyester powder coating.
 5. Gates: Construct gate frames with one and five-eighths inches outside diameter (1 $\frac{5}{8}$ " O.D.) rail material with welded corners. Provide fabric filler same as used in fence and use heavy duty galvanized hardware with lockable latches.
 - D. Workmanship: The complete fence shall be plumb, both in line and transverse to the fence, straight and rigid with fabric tightly stretched and held firmly in place. Details of construction not specified, shall be performed in keeping with standard good fencing practices.
 - E. Posts: Space all posts not more than eight feet (8') apart and set in concrete, as shown on the drawings.
 - F. Rails: Set rails as nearly parallel to the finish grade as possible and at the specified height of the fence.
-

- G. Fabric Ties: Provide a minimum of six (6) ties for each ten-foot (10') of rail and one tie to each foot of post height. Ties to tension wire shall be made with heavy galvanized hog rings at six (6) per ten foot (10') of tension wire.
- H. Tension Bands: Provide one (1) fastener for each one foot (1') of fabric height.
- I. Gates:
 - 1. Size: Clear opening 3 feet wide by 7 feet high.
 - 2. Provide with transom extending above gate opening to top of fence height indicated.

2.06 TENNIS COURT EQUIPMENT

- A. Manufacturers / Suppliers:
 - 1. E.J. Renner and Associates, Inc., Denver, CO.
 - 2. Substitutions: See Section 01 6000 - Product Requirements.
- B. Tennis Net Posts
 - 1. Model: Vogue 2.5.
 - 2. Internal brass worm-gear take-up, baked-on black polyester powder coating, continuous lacing rod, and galvanized sleeves. Two and half inches (2 ½") square with three-sixteenths inch (3/16") wall thickness.
 - 3. Set in concrete foundations three feet (3') deep by two feet (2') diameter. Net posts to be laid out according to the United States Tennis Court and Track Builders Association specifications.
- C. Nets
 - 1. Model: Edwards 30LS Double Top Net.
 - 2. 3.5 mm double stitched, braided polyethylene (three hundred ten pound – 310 lb. test) body, top six rows of net body are double mesh with extra heavy spun polyester headband.
 - 3. Hung flush with the net posts and thirty-six inches (36") high in the center.
- D. Center Straps
 - 1. Model: TWCS.
 - 2. Two and one-eighth inches (2 1/8") wide, white nylon webbing with adjusting buckle and bottom snap hook.
 - 3. Loop strap around net, hook into anchor, and tighten so that the net is thirty-six inches (36") high in the center.
- E. Center Strap Anchor
 - 1. Model: GAS-30.
 - 2. Anchor is tubular pipe nine inches (9") long by one and seven-eighths inches (1 7/8") diameter with a three-sixteenth inch (3/16") anchoring pin.
 - 3. Set in concrete eight inches by eight inches (8" x 8").
- F. Windscreen Curtain
 - 1. Nine foot (9') high Dacron windscreen fabricated of seven ounce (7 oz.) open mesh polyester with brass grommets every twelve inches (12") along the top, bottom, and sides.
 - 2. The nine foot (9') high curtains shall be accurately measured, fabricated, and attached with nine gauge (9 Ga.) galvanized hog rings and #8 polyrope for the center seam.
- G. Practice Backboards
 - 1. Panels to be green with an integrated white net line.
 - 2. Provide mounting system including all mounting hardware needed for a complete installation.
 - 3. See drawings for size and locations.

PART 3 EXECUTION

3.01 SOIL PREPARATION UNDER THE TENNIS COURTS SLAB

- A. The Contractor's Tennis Court Engineer shall review the geotechnical report(s) and submit proposed soil preparation under the tennis court to the Architect. The soil preparation shall achieve a reduction in the estimated potential vertical movement so that the estimated potential vertical movement is no more than one (1) inch according to the Geotechnical Engineer. The soil preparation shall be in accordance with the recommendations of the Geotechnical Report(s) provided with this Project Manual. If the Geotechnical Engineering report does not provide recommendations for reducing the potential vertical movement to no more than one (1) inch, Proposers shall not assume what will be acceptable but instead shall request information from the Architect at least five (5) days before submitting a proposal. If the Geotechnical Engineering report does not provide recommendations for achieving no more than a one (1) inch estimated potential vertical movement and a request for information is not submitted to the Architect at least five (5) days before Proposals are submitted, and the Proposal is accepted by the Owner, the Contractor shall be responsible for all costs to prepare the soil as recommended by the Geotechnical Engineer to achieve an estimated potential vertical movement of no more than one (1) inch.

3.02 INSTALLATION - TENNIS COURT POST-TENSIONED SLAB

- A. See Section 03 3800 - Post-Tensioned Concrete.

3.03 INSTALLATION - TENNIS COURT LIGHTING

- A. See Division 26 - Tennis Court Lighting

3.04 INSTALLATION - TENNIS COURT COLOR SURFACING

- A. Install in accordance with manufacturer's instructions.
- B. Verify that fencing, drainage, adjacent landscaping, lighting, net posts, center strap anchors, and any curb and gutter work is completed prior to color surfacing.
- C. Surface Preparation: Concrete shall have a wood float or broom finish. **DO NOT STEEL TROWEL CONCRETE. DO NOT ALLOW ANY CURING AGENTS OR HARDENERS TO BE USED.** Concrete must cure for 28 days. Thoroughly remove all dirt, dust, mud, oil, and foreign matter.
- D. The court(s) shall be flooded to check for depressions and irregularities. All depressions ponding water that covers the thickness of a nickel shall be outlined with a construction crayon and filled after acid treating the surface.
- E. Concrete Preparer: Concrete surface must be treated with concrete Preparer solution. After drying, all latent material must be removed from the surface.
- F. All depressions requiring correction shall be filled with Court Patch Binder according to specifications using the following mix:
 - 1. 100 lbs. 60 –80 mesh silica sand (dry).
 - 2. 3 gallons Plexipave court Patch Binder.
 - 3. 1 to 2 gallons Portland Cement (depending on temperature and humidity).
 - 4. Tack Coat – Tack coat is necessary under patches only and shall be as follows:
 - a. Plexipave Court Patch Binder diluted 1 part Court patch Binder to 2 parts water and allowed to dry prior to patching. After patching, the surface shall not vary more than 1/8 inch in 10 ft. measured in any direction.
- G. Primer Coat: Mix and apply California Ti-Coat epoxy primer according to Specification 10.17. NOTE: Plexibond may be used as an alternate for priming concrete courts.
- H. Acrylic Filler Coat: In order to provide a smooth, dense underlayment for the textured color surfacing, one or more applications of California Acrylic Resurfacer shall be applied to the surface according to specifications utilizing the following mix:

1. Acrylic Resurfacer – 55 gallons
 2. Water - 20-40 gallons
 3. Liquid yield = 112-138 gallons
 4. Sand (60 – 80 mesh) 600-900 lbs.
- I. Fortified Plexipave Textured Coats shall be applied by a rubber blade squeegee on the clean, dry surface in 3 applications. To obtain the proper application consistency, the Fortified Plexipave shall be mixed as follows:
1. Plexipave Color Base – 30 gallons
 2. Plexichrome – 20 gallons
 3. Water – 20 gallons
 4. The finished surface shall have a uniform appearance and be free from ridges and tool marks. Colors shall be as selected by the Architect.
- J. Playing Lines – Textured playing lines shall be accurately located, marked and painted with Plexicolor Line Paint, as specified by the U.S. Tennis Association.

3.05 INSTALLATION - TENNIS COURT CHAIN LINK FENCING

- A. Install according to the Chain Link Manufacturers Institute recommendations, these specification or the Design Engineer, whichever is greater.

3.06 INSTALLATION - TENNIS COURT EQUIPMENT

- A. Install according to the manufacturer's recommendation for each component.

3.07 ADJUSTING

- A. Align gates flush with the plane of the fence.

3.08 CLEANING

- A. Upon completion, remove all containers, surplus material and debris, and leave the site in a clean and orderly condition acceptable to the Owner.

END OF SECTION

**SECTION 32 3113
CHAIN LINK FENCES AND GATES**

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Work included: Provide chain link fence system where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 01 of these Specifications.

1.02 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.03 SUBMITTALS

- A. Comply with pertinent provisions of Section 01 3000 – Administrative Requirements.
- B. Product data: Within 15 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section;
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements;
 - 3. Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades;
 - 4. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.
 - 5. Samples: Accompanying the submittal described above, submit Samples of each sealant, each backing material, each primer, and each bond breaker proposed to be used.

1.04 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01 6000 – Product Requirements.

PART 2 – PRODUCTS

2.01 DIMENSIONAL DATA

- A. General:
 - 1. Pipe sizes indicated are commercial pipe sizes.
 - 2. Tube sizes indicated are nominal outside dimensions.
 - 3. H-section sizes indicated are normal flange dimensions.
 - 4. Roll-formed section sizes indicated are the nominal outside dimensions.

2.02 GALVANIZING

- A. On steel framework and appurtenances, provide galvanized finish with not less than the following weight of zinc per sq. ft.
 - 1. Pipe: 1.8 oz, complying with ASTM A120.
 - 2. H-sections and square tubing: 2.0 oz, complying with ASTM A123.
 - 3. Hardware and accessories: Comply with Table 1 of ASTM A153.
 - 4. Fabric: 2.0 oz, complying with class II of ASTM A121.

2.03 FABRIC

- A. Provide number 9 gage or 0.148" wires in 2" or 2-1/4" mesh (match existing), with top knuckled and bottom selvages twisted and knuckle.
- B. Where vinyl coating is indicated, provide black resin clad fabric shall have a polyvinyl chloride coating, minimum wall thickness of .015 inches over a galvanized substrate.
- C. Provide fabric in one piece widths.

2.04 POSTS, RAILS, AND ASSOCIATED ITEMS

- A. Where vinyl coated fabric is specified, all post, rails and associated items shall be coated to match.
 - B. End, corner, slope, and pull posts: Provide at least the following minimum sizes and weights:
 - 1. Material and dimensions:
 - a. Pipe, 3" outside dimension, Lbs. per lin ft: 5.79
 - b. Tubing, 2-1/2" square, Lbs per lin ft: 5.70
 - c. Roll-formed section, 3-1/2" x 3-1/2", Lbs per lin ft: 5.14
 - C. Line posts: Provide minimum sizes and weights as follows:
 - 1. Material and dimensions:
 - a. Pipe, 2.5" outside dimension, Lbs. per lin ft: 3.65,
 - b. H-section, 2.25" x 1.95" x 0.143", Lbs per lin ft: 10.10
 - D. Corner post: Provide 3" outside dimension, /lbs. per lin ft: 5.79
 - 1. All gate corners shall be welded and coated with a zinc base paint.
 - E. Gate posts: Provide gate posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:
 - 1. Material and dimension:
 - a. Pipe, 4" outside dimension: Lbs. per lin ft: 9.10
 - b. Tubing, 3" square:, Lbs. per lin ft: 9.10
 - c. H-section, 4", Lbs. per lin ft: 14.00
 - 1) Over 13 feet wide, and up to 18 feet wide: Use 6.625" outside diameter pipe weighing 14.0 lbs. per lin ft.
 - 2) Over 18 feet wide: Use 8.625" outside diameter pipe weighing 24.70 lbs. per lin ft.
 - F. Top rails:
 - 1. Use 1.625" outside diameter pipe weighing 1.80 lbs. per lin ft; or
 - 2. Use 1.625" x 1.25" roll-formed sections weighing 1.35 lbs. per lin ft.
 - 3. Provide in manufacturer's longest lengths, with expansion type couplings approximately 6" long for each joint.
 - 4. Provide means for attaching top rail securely to each gate, corner, pull, slope, and end post.
 - G. Center rail: Provide 1.625" outside diameter pipe 1.80 lbs. per lin ft; all around 4'-0" or taller.
 - H. Post brace assemblies:
 - 1. Provide at end and gate posts, and at both sides of corner, slope, and pull posts, with the horizontal brace located at mid-height of the fabric.
 - 2. Use 1.625" outside diameter pipe weighing 1.80 lbs. per lin ft for horizontal brace.
 - 3. Use 3/8" diameter rod with turnbuckle for diagonal truss.
 - I. Tension Brace: Provide 0.375 tension brace rod with adjustable fitting.
 - 1. Tenson rod to hook into brace rail cup or brace band as solid unit fitting.
 - J. Tension wire: Provide number 9 gage galvanized coiled spring wire at bottom of fabric.
 - 1. Tension wire shall be fastened to every line post with heavy gauge steel.
-

- K. Post tops:
 - 1. Provide steel, wrought iron, or malleable iron, designed as weathertight closure cap.
 - 2. Provide one cap for each post.
 - 3. Provide caps with openings to permit through passage of top rail.
- L. Stretcher bars:
 - 1. Provide one-piece lengths equal to full height of fabric, with a minimum cross-section of 3/16"x 3/4" unless otherwise noted.
 - 2. Provide one stretcher bar for each gate and end post, and two for each corner, slope, and pull post, except where fabric is woven integrally into the post.
- M. Stretcher bar bands:
 - 1. Provide steel, wrought iron, or malleable iron, to secure stretcher bars to end, corner, pull, slope, and gate posts.
 - 2. Bands may be used also with special fittings for securing rails to end, corner, pull, slope, and gate posts.

2.05 GATES

- A. General:
 - 1. Fabricate gate perimeter frames of tubular members.
 - 2. Provide additional horizontal and vertical members to assure proper operation of the gate, and for attachment of fabric, hardware, and accessories.
 - 3. Space so frame members are not more than 8 feet apart.
 - 4. Fabricate gate frames from:
 - a. Materials and dimension:
 - 1) Pipe 1.90" outside diameter, Lbs. per lin ft: 2.72
 - 2) Tubing, 2" square, Lbs. per lin ft: 2.60
 - 5. Where fencing is higher than gate, provide fence panel above gate to height of fence.
- B. Fabrication:
 - 1. Assemble gate frames by welding with special malleable or pressed steel fittings and rivets for rigid connections.
 - 2. Use same fabric as used in the fence.
 - 3. Install fabric with stretcher bars at vertical edges as a minimum.
 - 4. Attach stretchers to gate frame at not more than 15" on centers.
 - 5. Attach hardware with rivets or by other means which will provide security against removal and breakage.
 - 6. Provide diagonal cross-bracing consisting of 3/8" diameter adjustable length truss rods on gates where required to provide frame rigidity without sag or twist.
- C. Gate hardware: Provide following for each gate:
 - 1. Hinges:
 - a. Pressed or forged steel, or malleable iron, to suit the gate size; non-lift-off type, offset to permit 180 degree opening.
 - b. Provide 1-1/2 pr of hinges for each leaf.
 - 2. Latches:
 - a. Provide forked type or plunger-bar type to permit operation from either side of the gate.
 - b. Provide padlock eye as integral part of latch.
 - 3. Keeper: Provide keeper for vehicle gates, which automatically engages the gate leaf and holds it in the open position until manually released.
 - 4. Double gates:
 - a. Provide gate stops for double gates consisting of mushroom or flush plate, with anchors.
 - b. Set in concrete to engage the center drop rod or plunger bar.

- c. Provide locking device and padlock eyes as an integral part of the latch, requiring one padlock for locking both gate leaves.
- 5. Security gates:
 - a. For each leaf, top hinge shall be Locinox; MAMMOTH-180 Hydraulic Gate Closer & Hinge In One in Silver.
 - b. For additional security hardware refer to 08 7100 - Door Hardware.

2.06 MISCELLANEOUS MATERIALS AND ACCESSORIES

- A. Wire ties:
 - 1. For tying fabric to line posts, use number 9 gage wire ties spaced 15" on centers with 6 per post.
 - 2. For tying fabric to rails and braces, use number 9 gage wire ties spaced 18" on centers.
 - 3. For tying fabric to tension wire, use number 11 gage hog rings spaced 18" on centers.
 - 4. Manufacturer's standard wire ties will be acceptable if of equal strength and durability.
- B. Concrete: Comply with provisions of Section 03 3000 – Cast-in-Place Concrete for 2500 psi concrete.

PART 3 – EXECUTION

3.01 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 GUARANTEE

- A. The contractor shall furnish a written guarantee warranting all materials, devices, and workmanship to be free of defects for a period of one year from the date of completion and acceptance. Any defects in materials, devices, and workmanship which become apparent within the guarantee period shall be repaired or replaced by the contractor at his own expense, and at no additional cost to the Owner.

3.03 INSTALLATION

- A. General:
 - 1. Install posts at a maximum spacing of 10 feet on centers.
 - 2. Install corner or slope posts where changes in line or grade exceed a 30 degree deflection.
- B. Excavating:
 - 1. Drill holes for post footings in firm, undisturbed or compacted soil, strictly adhering to the dimensions and spacing shown.
 - 2. Post hole dimensions:
 - a. Provide 30" deep by 8" diameter foundations for line posts for 5 foot fabric height and less.
 - b. Provide 36" deep by 8" diameter foundations for line posts for fabric heights exceeding 5 feet.
 - c. Provide 36" deep by 12" diameter foundations for all other posts.
 - 3. Spread soil from excavations uniformly adjacent to the fence line, or on adjacent areas of the site if so directed.
 - 4. When solid rock is encountered near the surface, drill into rock at least 12" for line posts and at least 18" for end, pull, gate, and corner posts. Drill hole at least 1" greater diameter than the largest dimension of the post to be placed.
 - 5. If solid rock is below soil overburden, drill to full depth required, except penetration into rock need not exceed minimum depths specified above.
- C. Setting posts:

1. Remove loose and foreign materials from sides and bottoms of holes, and moisten soil prior to placing concrete.
 2. Center and align posts in holes.
 3. Place concrete around posts in a continuous pour, and vibrate or tamp for consolidation.
 4. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.
 5. Trowel tops of footings, and slope or dome to direct water away from posts.
 6. Extend footings for gate posts to the underside of bottom hinge.
 7. Set keeps, stops, sleeves, and other accessories into concrete as required.
 8. Keep exposed concrete surfaces moist for at least seven days after placement, or cure with membrane curing material or other curing method approved by the Architect.
 9. Grout-in those posts which are set into sleeved holes, concrete constructions, or rock excavations, using non-shrink Portland cement grout or other grouting material approved by the Architect.
- D. Concrete strength:
1. Allow concrete to attain at least 75% of its minimum 28-day strength before rails, tension wires, and/or fabric is installed.
 2. Do not, in any case, install such items in less than seven days after placement of concrete.
 3. Do not stretch and tension fabric and wire, and do not hang gates, until concrete has attained its full design strength.
- E. Rails and bracing:
1. Install fence with a top rail and bottom tension wire.
 2. Install top rails continuously through post caps or extension arms, bending to radius for curved runs.
 3. Provide expansion couplings as recommended by the fencing manufacturer.
 4. Provide bracing to the midpoint of the nearest line post or posts at all end, corner, slope, pull, and gate posts.
 5. Install tension wires parallel to the line of fabric by weaving through the fabric, and tying to each post with not less than number 6 gage galvanized wire, or by securing the wire to the fabric.
- F. Installing fabric:
1. Leave approximately 2" between finish grade and bottom selvage.
 2. Excavate high points in the ground to clear the bottom of the fence.
 3. Place and compact fill to within 1" of the bottom of the fabric in depressions.
 4. Pull fabric taut and tie to posts, rails, and tension wires.
 5. Install fabric on outward side facing side of fence, and anchor to framework so that the fabric remains in tension after pulling force is removed.
 6. Install stretcher bars by threading through or clamping to fabric on 4" centers, and secure to posts with metal bands spaced 15" on centers unless otherwise noted.
- G. Installing gates:
1. Install gates plumb, level, and secure for full opening without interference.
 2. Install ground-set items in concrete for anchorage in accordance with the fence manufacturer's recommendations as approved by the Architect.
 3. Lubricate and adjust the hardware for smooth operation.
- H. Miscellaneous:
1. Use U-shaped tie wires, conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least two full turns.
 2. Bend ends of wire to minimize hazards to persons and clothing.
 3. Fasteners:

- a. Install nuts for tension band and hardware bolts on side of fence opposite fabric side.
 - b. Peen the ends of bolts to prevent removal of nuts.
4. Repair coatings damaged in the shop or field erection, using a hot-applied repair compound applied in accordance with its manufacturer's recommendations as approved by the Architect.

END OF SECTION

**SECTION 33 0516
UTILITY STRUCTURES**

PART 1 – GENERAL

1.01 Section Includes

- A. Excavation and backfill.
 - A. Cast-in place concrete structures.
 - B. Precast concrete structures.
 - C. Metal components.

1.02 Related Sections

- A. Concrete formwork, concrete reinforcement, cast-in-place concrete, Portland cement concrete, concrete repair and finishing, and precast concrete are specified in the various Sections under Division 3 - Concrete.
- B. Interior trench drains and gratings for interior uses are specified in Section 05 50 00 - Metal Fabrication.
- C. Duct banks are specified in Section 20 50 16 - Underground Ductwork and Structures for Facility Services.

1.03 Measurement And Payment

- A. General: Measurement and payment for utility structures will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for utility structures indicated in the Bid Schedule of the Bid Form.
- B. Lump Sum: If the Bid Schedule indicates a lump sum for utility structures, the lump-sum method of measurement and payment will be in accordance with Section 01 20 00 - Price and Payment Procedures, Article 1.03.
- C. Unit Price: If the Bid Schedule indicates a unit price for utility structures, the unit-price method of measurement and payment will be as follows:

1. Measurement:

- a. Cast-in-place concrete and precast concrete units or structures and metal curb-and-gutter inlets will be measured for payment by the individual unit (each), installed in place. Each different type and size of concrete unit or structure will be measured separately for payment.

- b. Manhole covers and frames, grates and frames, pipe inlets and outlets, manhole steps, ladders, miscellaneous metal, reinforcing steel, and grounding will not be measured separately for payment, but will be included as part of the utility structure to which it is attached or embedded.
 - c. Excavation and backfill for utility structures will be measured separately for payment as specified in Section 31 00 00 - Earthwork, as applicable.
2. Payment: Utility structures will be paid for at the indicated Contract unit prices for the computed quantities as determined by the measurement method specified in Article 1.03.C.1, herein.

1.04 References

- A. American Society for Testing and Materials (ASTM):
- 1. ASTM A36/A36M Specification for Structural Steel
 - 2. ASTM A48 Specification for Gray Iron Castings
 - 3. ASTM A108 Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality
 - 4. ASTM A123 Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - 5. ASTM A153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - 6. ASTM A536 Specifications for Ductile Iron Castings
 - 7. ASTM B3 Specification for Soft or Annealed Copper Wire
 - 8. ASTM B26/B26M Specification for Aluminum-Alloy Sand Castings
 - 9. ASTM C33 Specification for Concrete Aggregates
 - 10. ASTM C150 Specification for Portland Cement
 - 11. ASTM C260 Specification for Air-Entraining Admixtures for Concrete
 - 12. ASTM C270 Specification for Mortar for Unit Masonry

13. ASTM C478 Specification for Precast Reinforced Concrete Manhole Sections
14. ASTM C618 Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
15. ASTM C789 Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers
16. ASTM C850 Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers with Less Than 2 feet of Cover Subjected to Highway Loadings
17. ASTM C858 Specification for Underground Precast Concrete Utility Structures
18. ASTM C891 Practice for Installation of Underground Precast Concrete Utility Structures

B. California Code of Regulations (CCR):

1. Title 24, Part 2, California Building Code, Chapter 21, Masonry, and State Chapter 21A, Masonry.

C. State of California, Department of Transportation (Caltrans):

1. Bridge Design Specifications Manual, Section 3, "Loads"

D. Underwriters Laboratories Inc. (UL):

1. UL 467 Grounding and Bonding Equipment

1.05 Submittals

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings: When not indicated on the Contract Drawings in sufficient detail or definition, submit detailed drawings of cast-in-place and precast concrete utility structures and related metal work.
- C. Product Data: Submit manufacturers' product data for standard manufactured precast concrete utility boxes and structures and for metal gratings and covers and other, related miscellaneous metal items.
- D. Certification: Submit certification or other acceptable evidence that covers and grates to be provided for roadways and parking areas meet proof-testing requirements for H₂O and HS₂O loadings in accordance with Caltrans Bridge Design Specifications Manual, Section 3.

PART 2 - PRODUCTS

2.01 Cast-In-Place Concrete Structures

- A. Materials: Comply with requirements of Section 03 05 15 - Portland Cement Concrete, except as specified otherwise herein.
 - 1. Portland Cement: ASTM C150, Type II, low alkali.
 - 2. Cementitious Admixture: Provide fly ash or pozzolan conforming with ASTM C618, Class F or N, not to exceed 15 percent by weight of the cement content.
 - 3. Aggregates: ASTM C33, fine aggregate and Size Nos. 56 or 57 (1-inch maximum size) coarse aggregate.
- B. Mix Design: Obtain design of concrete mix as specified in Section 03 05 15 - Portland Cement Concrete, and incorporate the following requirements:
 - 1. Concrete Strength: Class 4000 minimum in accordance with Table 03305-A of Section 03 05 15 - Portland Cement Concrete, except that electrical structures, such as vaults, pull boxes, and concrete for ductbanks, shall be Class 3000.
 - 2. Maximum water-cement plus pozzolan ratio: 0.45.
 - 3. Maximum slump: 4 inches.

2.02 Precast Concrete Structures

- A. General: The Contractor may provide precast concrete structures that conform to the general configuration, capacities, and inverts indicated.
- B. Fabrication Standards: Comply with requirements of Section 03 40 00 - Precast Concrete, and ASTM C478, ASTM C789, ASTM C850, and ASTM C858, as applicable, and applicable manufacturers' standards.
- C. Materials: Comply with requirements of Section 03 20 00 - Concrete Reinforcing, Section 03 05 15 - Portland Cement Concrete, and Section 03 40 00 - Precast Concrete, except as specified otherwise herein. Provide fine and coarse aggregates conforming to ASTM C33, in size commensurate with structure and reinforcement clearances.
- D. Portland Cement Concrete: Class 4000 minimum in accordance with Table 03305-A of Section 03 05 15 - Portland Cement Concrete. Concrete may be polymer or latex modified to achieve higher strengths and denser concrete. Concrete shall not deteriorate from chemical attack of sanitary waste.
 - 1. Concrete for electrical utility structures shall be Class 3000.
- E. Precast Covers: Precast covers shall have the utility identification, such as "PG&E Gas Valve," stamped into the cover.

- F. Quality Control: In accordance with Section 01 45 00 - Quality Control, the Contractor shall perform such inspections and tests as required to verify compliance with these Specifications.

2.03 Metal Covers, Grates, And Inlets

- A. Ferrous Castings:
1. Metal used in manufacture of castings shall conform to ASTM A48, Class 35B for Gray Iron, or ASTM A536, Grade 65-45-12 for Ductile Iron.
 2. Castings shall be of uniform quality, free from blowholes, shrinkage, distortion or other defects. Castings shall be smooth and cleaned by shotblasting.
 3. Minimum tensile strength shall be 35,000 psi.
 4. Castings shall be manufactured true to pattern; component parts shall fit together in a satisfactory manner. Round frames and covers shall have continuously machined bearing surfaces to prevent rocking and rattling.
 5. Where castings will be subjected to loads of H2O or greater, as indicated, provide ductile iron castings.
- B. Aluminum Castings: Where required to reduce weights of larger covers for ease of handling, such covers may be manufactured of aluminum castings conforming to ASTM B26/B26M, Alloy No. 713.0. Minimum tensile strength shall be 32,000 psi.
- C. Manhole Covers: Provide cast, manufactured manhole covers and frames with heavy-duty solid cover (lid) or vented cover (lid) as indicated. Covers shall be embossed or engraved with nonslip diamond or square cross-hatched pattern. Provide covers with embossed or engraved word identification, as indicated or appropriate, for the enclosed or underground utility.
- D. Grates:
1. Cast Ferrous Grates: Grates for area drains and catch basins shall be heavy-duty, bicycle safe inlet grates and frames of size and configuration indicated. Grates in roadways and parking areas shall withstand H2O loadings when proof-tested in accordance with Caltrans Bridge Design Specifications Manual, Section 3.
 2. Bar-Type Steel Grates: Refer to Section 05 50 00 - Metal Fabrications, for requirements. Bar-type steel gratings will be permitted only in areas where vehicular traffic will not be encountered.
- E. Curb and Gutter Inlets: Provide cast, manufactured curb inlet frame, grate, and curb box of size and configuration indicated. Curb and gutter inlets shall conform to the contour and profile of the concrete curb and gutter. Grates shall be heavy-duty and bicycle-safe and shall withstand H2O.

- F. Cast Iron Manhole Steps: Provide cast, manufactured manhole steps with cross-hatched treads and with anchor configuration appropriate for cast-in-place concrete or precast concrete as indicated. Provide steps for installation 12 inches on center in vertical alignment.

2.04 Miscellaneous Metal

- A. Requirements: Provide channel inserts, pulling eyes, ladders, and electrical grounding rods for electrical manholes and pull boxes as indicated.
- B. Steel Materials: Standard structural sections, shapes, plates, bars, and rods, as indicated, conforming with ASTM A36/A36M. Bars conforming with ASTM 108 will be acceptable.
- C. Anchors and Bolts: Conform with requirements of Section 05 50 00 - Metal Fabrications, as applicable. Bolts and studs, nuts, and washers shall be hot-dip galvanized in accordance with ASTM A153.
- D. Ladders: Provide standard-manufactured or custom-fabricated steel ladders as required to meet the conditions indicated. Steel ladders shall be hot-dip galvanized after fabrication.
- E. Grounding and Bonding Materials: Conform with UL 467 and the following requirements:
 - 1. Grounding Rods: Medium carbon steel core, copper-clad by the molten weld casting process, 3/4-inch diameter by 10 feet long in size.
 - 2. Bare Conductors: ASTM B3, No. 1/0 AWG, Class B stranded, annealed copper conductor.
- F. Fabrication: Form and fabricate the work as indicated. Include anchors, fasteners, and accessories to anchor and secure the work in place.
- G. Galvanizing: All ferrous metal items shall be galvanized after fabrication by the hot-dip process in accordance with ASTM A123. Weight of the zinc coating shall conform with the requirements specified under "Weight of Coating" in ASTM A123.

2.05 Mortar

- A. Cement mortar for the sealing of openings for pipe penetrations, for cementing of joints of component parts of precast structures, for providing of flow characteristics for the bottoms of drainage structures, and other features as indicated shall conform with the California Building Code, Chapter 21, Type S (without lime), with a minimum compressive strength at 28 days of 1,800 psi.
- B. Mortar shall comply with applicable requirements of ASTM C270, including measurement, mixing, proportioning, and water retention. Ten percent by volume of the cement content of the mortar shall be fly ash or pozzolanic material conforming with ASTM C618.

- C. Use mortar within 90 minutes after mixing. Discard mortar that has been mixed longer or that has begun to set. Re-tempering of mortar will not be permitted.

PART 3 - EXECUTION

3.01 Installation

- A. Requirements: Construct manholes, junction chambers, catch basins, curb and gutter inlets, trench drains, culverts, headwalls, wingwalls, pull boxes, utility boxes and vaults, and related utility structures in connection with the installation of pipe, conduits, ductbanks, and utility trenches, as indicated.
- B. Excavation and Backfill: Provide excavation, prepared subgrade and aggregate base, and backfill as specified in Section 31 00 00 - Earthwork, Section 33 05 28 - Trenching and Backfilling for Utilities, Section 32 11 17 - Aggregate Subbase Courses, and Section 32 11 23 - Aggregate Base Course, as indicated.
- C. Cast-in-Place Concrete Structures: Provide formwork, steel reinforcement, and concrete in accordance with applicable requirements of Section 03 11 00 - Concrete Forming, Section 03 20 00 - Concrete Reinforcing, and Section 03 30 00 - Cast-In-Place Concrete.
- D. Precast Concrete Structures: Install as indicated. Comply with applicable requirements of ASTM C891. Provide such appurtenances and installation accessories, including cement mortar and sealants, as required for a complete installation.
- E. Metal Components: Install manhole covers, grates and frames, curb and gutter inlets, metal steps, ladders, channel inserts, pulling eyes, and electrical grounding rods as indicated and in accordance with the respective manufacturer's instructions. Covers and grates in roadways, parking areas, and concrete walks shall be installed flush with adjacent, abutting pavement.

3.02 Field Quality Control

- A. The Contractor shall perform slump tests and strength tests of cast-in-place structures in accordance with the requirements specified in Section 03 05 15 - Portland Cement Concrete.
- B. Acceptance of cast-in-place structures will be in accordance with Section 03 05 15, Portland Cement Concrete.

END OF SECTION

**SECTION 33 0528
TRENCHING AND BACKFILLING FOR UTILITIES**

PART 1 - GENERAL

- 1.01 Section Includes
- A. Excavation, trenching, foundation, embedment, and backfill for installation of utilities, including manholes and other pipeline structures.
- 1.02 Measurement And Payment
- A. Unit Prices
1. No additional payment will be made for trench excavation, embedment and backfill under this Section. Include cost in unit price for installed underground piping, sewer, conduit, or duct work.
 2. When Project Manager directs Contractor to over excavate trench bottom, Contractor will be paid by unit price bid per linear foot under bid item - 6-inches Over Excavation of Trench Bottom.
 - a. No payment will be paid if Project Manager does not direct Contractor to over excavate trench bottom.
 - b. No over excavation will be measured or paid when unsuitable conditions result from dewatering system not in conformance with Section 01578 - Control of Ground and Surface Water.
 3. No additional payment will be made for performing Critical Location exploratory excavation. Include cost in unit price for installed underground piping, sewer, conduit, or duct work.
 4. Refer to Section 01270 - Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price
- 1.03 Definitions
- A. Pipe Foundation: Suitable and stable native soils that are exposed at trench subgrade after excavation to depth of bottom of bedding as shown on Drawings, or foundation backfill material placed and compacted in over-excavations.
- B. Pipe Bedding: Portion of trench backfill that extends vertically from top of foundation up to level line at bottom of pipe, and horizontally from one trench sidewall to opposite sidewall.
- C. Haunching: Material placed on either side of pipe from top of bedding up to springline of pipe and horizontally from one trench sidewall to opposite sidewall.
- D. Initial Backfill: Portion of trench backfill that extends vertically from springline of pipe (top of haunching) up to level line 12-inches above top of pipe, and horizontally from one trench sidewall to opposite sidewall.

- E. Pipe Embedment: Portion of trench backfill that consists of bedding, haunching and initial backfill.
- F. Trench Zone: Portion of trench backfill that extends vertically from top of pipe embedment up to pavement subgrade or up to final grade when not beneath pavement.
- G. Unsuitable Material: Unsuitable soil materials are the following:
 - 1. Materials that are classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.
 - 2. Materials that cannot be compacted to required density due to gradation, plasticity, or moisture content.
 - 3. Materials that contain large clods, aggregates, stones greater than 4-inches in any dimension, debris, vegetation, waste or any other deleterious materials.
 - 4. Materials that are contaminated with hydrocarbons or other chemical contaminants.
- H. Suitable Material: Suitable soil materials are those meeting specification requirements. Materials mixed with lime, fly ash, or cement that can be compacted to required density and meeting requirements for suitable materials may be considered suitable materials, unless otherwise indicated.
- I. Backfill: Suitable material meeting specified quality requirements placed and compacted under controlled conditions.
- J. Ground Water Control Systems: Installations external to trench, such as well points, eductors, or deep wells. Ground water control includes dewatering to lower ground water, intercepting seepage which would otherwise emerge from side or bottom of trench excavation, and depressurization to prevent failure or heaving of excavation bottom. Refer to Section 01578 - Control of Ground Water and Surface Water.
- K. Surface Water Control: Diversion and drainage of surface water runoff and rain water away from trench excavation. Rain water and surface water accidentally entering trench shall be controlled and removed as part of excavation drainage.
- L. Excavation Drainage: Removal of surface and seepage water in trench by sump pumping and using drainage layer, as defined in ASTM D 2321, placed on foundation beneath pipe bedding or thickened bedding layer of Class I material.
- M. Trench Conditions are defined with regard to stability of trench bottom and trench walls of pipe embedment zone. Maintain trench conditions that provide for effective placement and compaction of embedment material directly on or against undisturbed soils or foundation backfill, except where structural trench support is necessary.
 - 1. Dry Stable Trench: Stable and substantially dry trench conditions exist in pipe embedment zone as result of typically dry soils or achieved by ground water control (dewatering or depressurization) for trenches extending below ground water level.
 - 2. Stable Trench with Seepage: Stable trench in which ground water seepage is controlled by excavation drainage.

- a. Stable Trench with Seepage in Clayey Soils: Excavation drainage is provided in lieu of or to supplement ground water control systems to control seepage and provide stable trench subgrade in predominately clayey soils prior to bedding placement.
 - b. Stable Wet Trench in Sandy Soils: Excavation drainage is provided in embedment zone in combination with ground water control in predominately sandy or silty soils.
3. Unstable Trench: Unstable trench conditions exist in pipe embedment zone if ground water inflow or high-water content causes soil disturbances, such as sloughing, sliding, boiling, heaving or loss of density.
- N. Sub-trench: Sub-trench is special case of benched excavation. Sub-trench excavation below trench shields or shoring installations may be used to allow placement and compaction of foundation or embedment materials directly against undisturbed soils. Depth of sub-trench depends upon trench stability and safety as determined by Contractor.
- O. Trench Dam: Placement of low permeability material in pipe embedment zone or foundation to prohibit ground water flow along trench.
- P. Over-excavation and Backfill: Excavation of subgrade soils with unsatisfactory bearing capacity or composed of otherwise unsuitable materials below top of foundation as shown on Drawings and backfilled with foundation bedding.
- Q. Foundation Bedding: Natural soil or manufactured aggregate of controlled gradation, and geotextile filter fabrics as required, to control drainage and material separation. Foundation bedding is placed and compacted as backfill to provide stable support for bedding. Foundation bedding materials may include concrete seal slabs.
- R. Trench Safety Systems include both protective systems and shoring systems as defined in Section 02260 - Trench Safety Systems.
- S. Trench Shield (Trench Box): Portable worker safety structure moved along trench as work proceeds, used as protective system and designed to withstand forces imposed on it by cave in, thereby protecting persons within trench. Trench shields may be stacked if so designed or placed in series depending on depth and length of excavation to be protected.
- T. Shoring System: Structure that supports sides of an excavation to maintain stable soil conditions and prevent cave-ins, or to prevent movement of ground affecting adjacent installations or improvements.
- U. Special Shoring: Shoring system meeting special shoring as specified in Paragraph 1.08, Special Shoring Design Requirements, for locations identified on Drawings.
- V. Vacuum Excavation: An excavation technique performed by an experienced subcontractor in which water or air jetting is used to slough off and vacuum away soil.
- W. Large Diameter Water Line (LDWL): Water line that is 24-inches in diameter or larger. X. Emergency Action Plan (EAP): The EAP document should include a discussion of procedures for timely and reliable detection, classification (level of

emergency) and response procedure to a potential emergency condition associated with a large diameter water line.

- X. Subsurface Utility Exploration (SUE): Non-destructive excavation, unless otherwise approved by project manager.

1.04 References

- A. ASTM A 798 – Standard Practice for Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications.
- B. ASTM C 12 - Standard Practice for Installing Vitrified Clay Pipelines.
- C. ASTM C 891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures
- D. ASTM C 1479 - Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations
- E. ASTM C 1675 - Standard Practice for Installation of Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers
- F. ASTM C 1821 - Standard Practice for Installation of Underground Circular Precast Concrete Manhole Structures
- G. ASTM D 558 - Standard Test Methods for Moisture-Density (Unit Weight) Relations of Soil-Cement Mixtures.
- H. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft³ (600 kN-m/m³)).
- I. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.
- J. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.
- K. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classifications System).
- L. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- M. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
- N. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- O. TxDOT Tex-101-E - Preparing Soil and Flexible Base Materials for Testing.
- P. TxDOT Tex-110-E - Particle Size Analysis of Soils.
- Q. Federal Regulations, 29 CFR Part 1926, Standards-Excavation, Occupational Safety and Health Administration (OSHA).

- 1.05 Scheduling
 - A. Schedule work so that pipe embedment can be completed on same day that acceptable foundation has been achieved for each section of pipe installation, manhole, or other structures.
 - B. For proposed utility adjacent to or across existing LDWL:
 - 1. Conduct a meeting between contractor, Drinking Water Operations and Utility Maintenance Branch prior to beginning excavation to coordinate the EAP in the event a water line shut down becomes necessary.
 - 2. Notify Drinking Water Operations a minimum of 1 week prior to beginning construction activities.
 - 3. Notify Drinking Water Operations a minimum of 48 hours prior to beginning SUE work near LDWL.
 - 4. Unless otherwise approved by City Engineer, perform construction activities between 7 AM and 7 PM, Monday through Friday. No work permitted around a LDWL on weekends or City Holiday.
 - 5. A City Inspector must be present during SUE or construction activities occurring within four feet or one diameter of the LDWL, whichever is greater, from a LDWL or appurtenance.
- 1.06 Submittals
 - A. Conform to requirements of Section 01330 - Submittal Procedures.
 - B. Submit planned typical method of excavation, backfill placement and compaction including:
 - 1. Trench widths.
 - 2. Procedures for foundation and pipe zone bedding placement, and trench backfill compaction.
 - 3. Procedures for assuring compaction against undisturbed soil when pre-manufactured trench safety systems are proposed.
 - C. Submit backfill material sources and product quality information in accordance with requirements of Section 02320 - Utility Backfill Materials.
 - D. Submit trench excavation safety program in accordance with requirements of Section 02260 - Trench Safety System. Include designs for special shoring meeting requirements defined in Paragraph 1.08, Special Shoring Design Requirements contained herein.
 - E. Submit record of location of utilities as installed, referenced to survey control points. Include locations of utilities encountered or rerouted. Give stations, horizontal dimensions, elevations, inverts, and gradients.
 - F. Submit 11-inch by 17-inch or 12-inch by 18-inch copy of Drawing with plotted utility or obstruction location titled "Critical Location Report" to Project Manager.

- G. For installation of proposed utility adjacent to or across existing LDWL, prepare and submit the following to Drinking Water Operations prior to beginning construction activities. Obtain approval from Drinking Water Operations prior to commencing prelocate or utility work near LDWL.
 - 1. Trench details, shoring system designs, installation sequences, and flowable fill mix designs.
 - 2. Emergency Action Plan (EAP) to address contingency plans in the event of damage to or failure of LDWL. Include the following:
 - a. Contact personnel and agencies including primary and secondary telephone numbers.
 - b. Contractor's hierarchy of responsible personnel.
 - c. Traffic control measures.
 - d. Identification of resources to be available on or near project site in event of damage to or failure of LDWL.

1.07 Tests

- A. Testing and analysis of backfill materials for soil classification and compaction during construction will be performed by an independent laboratory provided by City in accordance with requirements of Section 01454 - Testing Laboratory Services and as specified in this Section.
- B. Perform backfill material source qualification testing in accordance with requirements of Section 02320 - Utility Backfill Materials.

1.08 Special Shoring Design Requirements

- A. Have special shoring designed or selected by Contractor's Professional Engineer to provide support for sides of excavations, including soils and hydrostatic ground water pressures as applicable, and to prevent ground movements affecting adjacent installations or improvements such as structures, pavements and utilities. Special shoring may be a premanufactured system selected by Contractor's Professional Engineer to meet project site requirements based on manufacturer's standard design.

PART 2 - PRODUCTS

2.01 Equipment

- A. Perform excavation with hydraulic excavator or other equipment suitable for achieving requirements of this Section.
- B. Use only hand-operated tamping equipment until minimum cover of 12-inches is obtained over pipes, conduits, and ducts. Do not use heavy compacting equipment until adequate cover is attained to prevent damage to pipes, conduits, or ducts.
- C. Use trench shields or other protective systems or shoring systems which are designed and operated to achieve placement and compaction of backfill directly against undisturbed native soil.

- D. Use special shoring systems where required which may consist of braced sheeting, braced soldier piles and lagging, slide rail systems, or other systems meeting requirements as specified in Paragraph 1.08, Special Shoring Design Requirements.

2.02 Material Classifications

- A. Embedment and Trench Zone Backfill Materials: Conform to classifications and product descriptions of Section 02320 - Utility Backfill Materials and Section 02321 – Cement Stabilized Sand.
- B. Concrete Backfill: Conform to requirements for Class B concrete as specified in Section 03315 - Concrete for Utility Construction.
- C. Geotextile (Filter Fabric): Conform to requirements of Section 02621 Geotextile.
- D. Concrete for Trench Dams: Concrete backfill or 3 sack premixed (bag) concrete.

PART 3 - EXECUTION

3.01 Standard Practice

- A. Install flexible pipe, including "semi-rigid" pipe, to conform to standard practice described in ASTM D 2321, and as described in this Section. Where an apparent conflict occurs between standard practice and requirements of this Section, this Section governs.
- B. Install rigid pipe to conform to standard practice described in ASTM C 12, C 1479, or C 1675as applicable, and as described in this Section. Where an apparent conflict occurs between standard practice and requirements of this Section, this Section governs.

3.02 Preparation

- A. Establish traffic control to conform to requirements of Section 01555 - Traffic Control and Regulation. Maintain barricades and warning lights for streets and intersections affected by Work, and are considered hazardous to traffic movements.
- B. Perform work to conform to applicable safety standards and regulations. Employ trench safety system as specified in Section 02260 - Trench Safety Systems.
- C. Immediately notify agency or company owning any existing utility line which is damaged, broken, or disturbed. Obtain approval from Project Manager and agency for any repairs or relocations, either temporary or permanent.
- D. Remove existing pavements and structures, including sidewalks and driveways, to conform to requirements of Section 02221 - Removing Existing Pavements, Structures, Wood and Demolition Debris, as applicable.
- E. Install and operate necessary dewatering and surface-water control measures to conform to Section 01578 - Control of Ground and Surface Water. Provide stable trench to allow installation in accordance with Specifications.
- F. Maintain permanent benchmarks, monumentation, and other reference points. Unless otherwise directed in writing, replace those which are damaged or destroyed in accordance with Section 01725 - Field Surveying.

3.03 Critical Location Investigation

- A. Horizontal and vertical location of various underground lines shown on Drawings, including but not limited to water lines, gas lines, storm sewers, sanitary sewers, telecommunication lines, electric lines or power ducts, pipelines, concrete and debris, are based on best information available but are only approximate locations. Unless otherwise approved by Project Manager, at Critical Locations shown on Drawings, perform vacuum excavation to field verify horizontal and vertical locations of such lines within a zone 2 feet vertically and 4 feet horizontally of proposed work exclude water jetting at PCCP water line.
1. Verify location of existing utilities minimum of 7 working days in advance of pipe laying activities based on daily pipe laying rate or prior to beginning installation of auger pit or tunnel shaft. Use extreme caution and care when uncovering utilities designated by Critical Locate.
 2. Notify Project Manager in writing immediately upon identification of obstruction. In event of failure to identify obstruction in minimum of 7 days, Contractor will not be entitled to extra cost for downtime including, but not limited to, payroll, equipment, overhead, demobilization and remobilization, until 7 days has passed from time Project Manager is notified of obstruction.
- B. Notify involved utility companies of date and time that investigation excavation will occur and request that their respective utility lines be marked in field. Comply with utility or pipeline company requirements that their representative be present during excavation. Provide Project Manager with 48 hours notice prior to field excavation or related work.
- C. Survey vertical and horizontal locations of obstructions relative to project baseline and datum and plot on 12-inch by 18-inch copy of Drawings. For large diameter water lines, submit to Project Manager for approval, horizontal and vertical alignment dimensions for connections to existing lines, tied into project baseline, signed and sealed by R.P.L.S.
- D. LDWL Prelocate Requirements:
1. Field-locate LDWL, appurtenances and laterals connected directly to LDWL through use of non-probing method such as a vacuum truck (non-water jetting method) at no greater than 50-foot intervals. Locate upstream and downstream of proposed work or utility installation.
 2. Record crown and side of LDWL adjacent to proposed work or utility installation. Record LDWL locations horizontally and vertically using same coordinate system employed on proposed utility drawings.
 3. Tie horizontal and vertical coordinates into project baseline. Submit recordings performed by R.P.L.S to City a minimum of 14 days prior to mobilizing to site.

3.04 Protection

- A. Protect trees, shrubs, lawns, existing structures, and other permanent objects outside of grading limits and within grading limits as designated on Drawings, and in accordance with requirements of Section 01562 - Tree and Plant Protection.
- B. Protect and support above-grade and below-grade utilities which are to remain.

- C. Restore damaged permanent facilities to pre-construction conditions unless replacement or abandonment of facilities is indicated on Drawings.
- D. Take measures to minimize erosion of trenches. Do not allow water to pond in trenches.
Where slides, washouts, settlements, or areas with loss of density or pavement failures or potholes occur, repair, re-compact, and pave those areas at no additional cost to City.
- E. Contingency plans for proposed work or utility installation adjacent to or across a LDWL:
 - 1. Conduct on-site emergency drill prior to commencing proposed utility installation, and at three month intervals to assure EAP is current.
 - 2. In the event a LDWL shut down becomes necessary, secure site and provide assistance to City personnel to access pipe and isolation valves as needed.

3.05 Excavation

- A. Except as otherwise specified or shown on Drawings, install underground utilities in open cut trenches with vertical sides.
- B. Perform excavation work so that pipe, conduit, and ducts can be installed to depths and alignments shown on Drawings. Avoid disturbing surrounding ground and existing facilities and improvements.
- C. Determine trench excavation widths using following schedule as related to pipe outside diameter (O.D.). Excavate trench so that pipe is centered in trench.

Nominal Pipe Size, Inches	Minimum Trench Width, Inches
Less than 18	O.D. + 18
18 to 30	O.D. + 24
36 to 42	O.D. + 36
Greater than 42	O.D. + 48

Do not obstruct sight distance for vehicles utilizing roadway or detours with stockpiled materials.

- D. Use sufficient trench width or benches above embedment zone for installation of well point headers or manifolds and pumps where depth of trench makes it uneconomical or impractical to pump from surface elevation. Provide sufficient space between shoring cross braces to permit equipment operations and handling of forms, pipe, embedment and backfill, and other materials.
- E. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue work at that location. Notify Project Manager and obtain instructions before proceeding.
- F. Shoring of Trench Walls.
 - 1. Install Special Shoring in advance of trench excavation or simultaneously with trench excavation, so that soils within full height of trench excavation walls will

2. remain laterally supported at all times.
 3. For all types of shoring, support trench walls in pipe embedment zone throughout installation. Provide trench wall supports sufficiently tight to prevent washing trench wall soil out from behind trench wall support.
 4. Leave sheeting driven into or below pipe embedment zone in place to preclude loss of support of foundation and embedment materials, unless otherwise directed by Project Manager. Leave rangers, walers, and braces in place as long as required to support sheeting, which has been cut off, and trench wall in vicinity of pipe zone.
 5. Employ special methods for maintaining integrity of embedment or foundation material. Before moving supports, place and compact embedment to sufficient depths to provide protection of pipe and stability of trench walls. As supports are moved, finish placing and compacting embedment.
 6. If sheeting or other shoring is used below top of pipe embedment zone, do not disturb pipe foundation and embedment materials by subsequent removal. Maximum thickness of removable sheeting extending into embedment zone shall be equivalent of 1-inch-thick steel plate. As sheeting is removed, fill in voids left with grouting material.
- G. Use of Trench Shields. When trench shield (trench box) is used as worker safety device, the following requirements apply:
1. Make trench excavations of sufficient width to allow shield to be lifted or pulled freely, without damage to trench sidewalls.
 2. Move trench shields so that pipe, and backfill materials, after placement and compaction, are not damaged nor disturbed, nor degree of compaction reduced. Re- compact after shield is moved if soil is disturbed.
 3. When required, place, spread, and compact pipe foundation and bedding materials beneath shield. For backfill above bedding, lift shield as each layer of backfill is placed and spread. Place and compact backfill materials against undisturbed trench walls and foundation.
 4. Maintain trench shield in position to allow sampling and testing to be performed in safe manner.
 5. Conform to applicable Government regulations.
- H. Voids under paving area outside shield caused by Contractor's work will require removal of pavement, consolidation and replacement of pavement in accordance with Contract Documents. Repair damage resulting from failure to provide adequate supports.
- I. Place sand or soil behind shoring or trench shield to prevent soil outside shoring from collapsing and causing voids under pavement. Immediately pack suitable material in outside voids following excavation to avoid caving of trench walls.

- J. Coordinate excavation within 15 feet of pipeline with company's representative. Support pipeline with methods agreed to by pipeline company's representative. Use small, rubber-tired excavator, such as backhoe, to do exploratory excavation. Bucket that is used to dig in close proximity to pipelines shall not have teeth or shall have guard installed over teeth to approximate bucket without teeth. Excavate by hand within 1 foot of Pipeline Company's line. Do not use larger excavation equipment than normally used to dig trench in vicinity of pipeline until pipelines have been uncovered and fully exposed. Do not place large excavation and hauling equipment directly over pipelines unless approved by Pipeline Company's representative.
- K. When, during excavation to uncover pipeline company's pipelines, screwed collar or an oxy-acetylene weld is exposed, immediately notify Project Manager. Provide supports for collar or welds. Discuss with Pipeline Company's representative and determine methods of supporting collar or weld during excavation and later backfilling operations. When collar is exposed, request Pipeline Company to provide welder in a timely manner to weld ends of collar prior to backfilling of excavation.
- L. Excavation and shoring requirements for proposed work or utility installation adjacent to or across a LDWL:
 - 1. Identify LDWL area in field and barricade off from construction activities. Allow no construction related activities including, but not limited to, loading of dump trucks and material staging or storage, on top of LDWL.
 - 2. Employ a groundwater control system when performing excavation activities within ten feet of LDWL to:
 - a. Effectively reduce hydrostatic pressure affecting excavations,
 - b. Develop substantially dry and stable subgrade for subsequent construction operations,
 - c. Prevent loss of fines, seepage, boils, quick condition or softening of foundation strata, and
 - d. Maintain stability of sides and bottom of excavations.
 - 3. When edge of proposed trench or shoring is within a distance equal to one diameter of LDWL from outside of wall of LDWL, valve or appurtenance:
 - a. Maintain minimum of four (4) feet horizontal clearance and minimum of two (2) feet vertical clearance between proposed utility and LDWL.
 - b. Auger Construction
 - 1) Maintain minimum of four (4) feet horizontal clearance between proposed utility and LDWL.
 - 2) Dry auger method required when auger hole is 12-inches and larger in diameter.

- c. Open Cut Construction and Auger pits
 - 1) Perform hand excavation when within four (4) feet of LDWL.
 - 2) Employ hydraulic or pneumatic shoring system. Do not use vibratory or impact driven shoring or piling.
 - 3) Expose no more than 30-feet of trench prior to backfilling.
 - 4) A maximum of one (1) foot of vertical trench shall be un-braced at a time to maintain constant pressure on face of excavated soil.
 - 5) Upon removal of shoring system, inject flowable fill into void space left behind by shoring system. Comply with Standard Specification 02322 - Flowable Fill.
- d. When edge of utility excavation is greater than one diameter of LDWL from outside wall of LDWL, use a shielding system as required by Project Manager and proposed utility standards and practices.

3.06 Handling Excavated Materials

- A. Use only excavated materials, which are suitable as defined in this Section and conforming to Section 02320 - Utility Backfill Materials. Place material suitable for backfilling in stockpiles at distance from trench to prevent slides or cave-ins.
- B. When required, provide additional backfill material conforming to requirements of Section 02320 - Utility Backfill Materials.
- C. Do not place stockpiles of excess excavated materials on streets and adjacent properties. Protect backfill material to be used on site. Maintain site conditions in accordance with Section 01504 - Temporary Facilities and Controls. Excavate trench so that pipe is centered in trench. Do not obstruct sight distance for vehicles utilizing roadway or detours with stockpiled materials.

3.07 Trench Foundation

- A. Excavate bottom of trench to uniform grade to achieve stable trench conditions and satisfactory compaction of foundation or bedding materials.
- B. When wet soil is encountered on trench bottom and dewatering system is not required, over excavate an additional 6-inches with approval by Project Manager. Place non-woven geotextile fabric and then compact 12-inches of crushed stone in one lift on top of fabric. Compact crushed stone with four passes of vibratory-type compaction equipment.
- C. Perform over excavation, when directed by Project Manager, in accordance with Paragraph 3.07.B above. Removal of unstable or unsuitable material may be required if approved by Project Manager;
 - 1. Even though Contractor has not determined material to be unsuitable, or

2. If unstable trench bottom is encountered and an adequate ground water control system is installed and operating according to Section 01578 - Control of Ground and Surface Water.

D. Place trench dams in Class I foundations in line segments longer than 100 feet between manholes and not less than one in every 500 feet of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5 feet from manholes.

3.08 Pipe Embedment, Placement, and Compaction

A. Remove loose, sloughing, caving, or otherwise unsuitable soil from bottoms and sidewalls of trenches immediately prior to placement of embedment materials.

B. Place embedment including bedding, haunching, and initial backfill as shown on Drawings.

C. For pipe installation, manually spread embedment materials around pipe to provide uniform bearing and side support when compacted. Protect flexible pipe from damage during placing of pipe zone bedding material. Perform placement and compaction directly against undisturbed soils in trench sidewalls, or against sheeting which is to remain in place.

D. Do not place trench shields or shoring within height of embedment zone unless means to maintain density of compacted embedment material are used. If moveable supports are used in embedment zone, lift supports incrementally to allow placement and compaction of material against undisturbed soil.

E. Place geotextile to prevent particle migration from in-situ soil into open-graded (Class I) embedment materials or drainage layers.

F. Do not damage coatings or wrappings of pipes during backfilling and compacting operations. When embedding coated or wrapped pipes, do not use crushed stone or other sharp, angular aggregates.

G. Place haunching material manually around pipe and compact it to provide uniform bearing and side support. If necessary, hold small-diameter or lightweight pipe in place during compaction of haunch areas and placement beside pipe with sand bags or other suitable means.

H. Place electrical conduit, if used, directly on foundation without bedding.

I. Shovel in-place and compact embedment material using pneumatic tampers in restricted areas, and vibratory-plate compactors or engine-powered jumping jacks in unrestricted areas. Compact each lift before proceeding with placement of next lift. Water tamping is not allowed.

J. For water lines construction embedment, use bank run sand, concrete sand, gem sand, pea gravel, or crushed limestone as specified in Section 02320 - Utility Backfill Material. Adhere to the following subparagraph numbers 1 and 2.

1. Class I, II and III Embedment Materials:

a. Maximum 6-inches compacted lift thickness.

- b. Compact to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698.
 - c. Moisture content to be within -3 percent to +5 percent of optimum as determined according to ASTM D 698, unless otherwise approved by Project Manager.
 - 2. Cement Stabilized Sand (where required for special installations):
 - a. Maximum 6-inches compacted thickness.
 - b. Compact to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698.
 - c. Moisture content to be on dry side of optimum as determined according to ASTM D 698 but sufficient for effective hydration.
- K. For Sanitary Sewers adhere to subparagraph number 1 and 2. For Storm Sewers provide cement stabilized sand per paragraph 2. This provision does not apply to Storm Sewers constructed of HDPE pipe installed under pavement.
 - 1. Class I Embedment Materials.
 - a. Maximum 6-inches compacted lift thickness.
 - b. Systematic compaction by at least two passes of vibrating equipment. Increase compaction effort as necessary to effectively embed pipe to meet deflection test criteria.
 - c. Moisture content as determined by Contractor for effective compaction without softening soil of trench bottom, foundation or trench walls.
 - 2. Class II Embedment and Cement Stabilized Sand.
 - a. Maximum 6-inches compacted thickness.
 - b. Compaction by methods determined by Contractor to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698 for Class II materials and according to ASTM D 558 for cement stabilized materials.
 - c. Moisture content of Class II materials within 3 percent of optimum as determined according to ASTM D 698. Moisture content of cement stabilized sands on dry side of optimum as determined according to ASTM D 558 but sufficient for effective hydration.
- L. For Storm Sewers constructed of any flexible pipe product and installed under pavement provide flowable fill pipe embedment as specified in Section 02322 - Flowable Fill.

- M. Place trench dams in Class I embedment in line segments longer than 100 feet between manholes, and not less than one in every 500 feet of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5 feet from manholes.

3.09 Trench Zone Backfill Placement and Compaction

- A. Place backfill for pipe or conduits and restore surface as soon as practicable. Leave only minimum length of trench open as necessary for construction.
- B. For water lines, under pavement and to within one foot back of curb, use backfill materials described below:
 - 1. For water lines 20-inches in diameter and smaller, use bank run sand or select backfill materials up to pavement base or subgrade.
 - 2. For water lines 24-inches in diameter and larger, backfill with suitable on-site material (random backfill) up to 12-inches below pavement base or subgrade. Place minimum of 12-inches of select backfill below pavement base or subgrade.
- C. For sewer pipes (Storm and Sanitary), use backfill materials described by trench limits. For "trench zone backfill" under pavement and to within one foot back of curb, use cement stabilized sand for pipes of nominal sizes 36-inches in diameter and smaller to level 12 inches below the pavement. For sewer pipes 42-inches in diameter and larger, under pavement or natural ground, backfill from 12-inches above top of pipe to 120 inches below pavement with suitable on-site material or select backfill. Use select backfill for rigid pavements or flexible base material for asphalt pavements for 12-inch backfill directly under pavement. For backfill materials reference Section 02320 - Utility Backfill Materials. This provision does not apply where a Storm Sewer is constructed of any flexible pipe product.
- D. For Storm Sewers constructed of any flexible pipe product and installed under pavement provide flowable fill as specified in Section 02322 - Flowable Fill. For Storm Sewers constructed of any flexible pipe product and not installed under pavement provide cement stabilized sand.
- E. Where damage to completed pipe installation work is likely to result from withdrawal of sheeting, leave sheeting in place. Cut off sheeting 1.5-feet or more above crown of pipe. Remove trench supports within 5-feet from ground surface.
- F. Unless otherwise shown on Drawings. Use one of the following trench zone backfills under pavement and to within one foot of edge of pavement. Place trench zone backfill in lifts and compact. Fully compact each lift before placement of next lift.
 - 1. Class I, II, or III or combination thereof:
 - a. Place in maximum 12-inch thick loose layers.
 - b. Compact by vibratory equipment to minimum of 95 percent of maximum dry density determined according to ASTM D 698.

- c. Moisture content within zero percent to 5 percent above optimum determined according to ASTM D 698, unless otherwise approved by Project Manager.
 - 2. Cement-Stabilized Sand:
 - a. Maximum lift thickness determined by Contractor to achieve uniform placement and required compaction, but do not exceed 12-inches.
 - b. Compact by vibratory equipment to minimum of 95 percent of maximum dry density determined according to ASTM D 558.
 - c. Moisture content on dry side of optimum determined according to ASTM D 558 but sufficient for cement hydration.
 - 3. Class IVA and IVB (Clay Soils):
 - a. Place in maximum 8-inch thick loose lifts.
 - b. Compaction by vibratory Sheepfoot roller to minimum of 95 percent of maximum dry density determined according to ASTM D 698.
 - c. Moisture content within zero percent to 5 percent above optimum determined according to ASTM D 698, unless approved by Project Manager.
 - G. Unless otherwise shown on Drawings, for trench excavations not under pavement, random backfill of suitable material may be used in trench zone. This provision does not apply to flexible pipe used for storm sewers.
 - 1. Fat clays (CH) may be used as trench zone backfill outside paved areas at Contractor's option. When required density is not achieved, at any additional cost to City, rework, dry out, use lime stabilization or other approved methods to achieve compaction requirements, or use different suitable material.
 - 2. Maximum 9-inch compacted lift thickness for clayey soils and maximum 12-inch lift thickness for granular soils.
 - 3. Compact to minimum of 90 percent of maximum dry density determined according to ASTM D 698.
 - 4. Moisture content as necessary to achieve density.
 - H. For electric conduits, remove form work used for construction of conduits before placing trench zone backfill.
- 3.10 Manholes, Junction Boxes and Other Pipeline Structures
- A. Below paved areas or where shown on Drawings, encapsulate manhole with cement stabilized sand; minimum of 2 foot below base, minimum 2 foot around walls, up to pavement

subgrade or natural ground. Compact in accordance with Paragraph 3.09.F.2 of this Section.

- B. In unpaved areas, use select fill for backfill. Existing material that qualifies as select material may be used, unless indicated otherwise on Drawings. Deposit backfill in uniform layers and compact each layer as specified. Maintain backfill material at no less than 2 percent below nor more than 5 percent above optimum moisture content, unless otherwise approved by Project Manager. Place fill material in uniform 8-inch maximum loose layers. Compact fill to at least 95 percent of maximum Standard Proctor Density according to ASTM D 698.
- C. For LDWL projects, encapsulate manhole with cement stabilized sand; minimum of 1 foot below base, minimum of 2 feet around walls, up to within 12-inches of pavement subgrade or natural ground. For manholes over water line, extend encapsulation to bottom of trench. Compact in accordance with Paragraph 3.09 F.2 of this Section.

3.11 Field Quality Control

- A. Test for material source qualifications as defined in Section 02320 - Utility Backfill Materials.
- B. Provide excavation and trench safety systems at locations and to depths required for testing and retesting during construction at no additional cost to City.
- C. Tests will be performed on minimum of three different samples of each material type for plasticity characteristics, in accordance with ASTM D 4318, and for gradation characteristics, in accordance with Tex-101-E and Tex-110-E. Additional classification tests will be performed whenever there is noticeable change in material gradation or plasticity, or when requested by Project Manager.
- D. At least three tests for moisture-density relationships will be performed initially for backfill materials in accordance with ASTM D 698, and for cement- stabilized sand in accordance with ASTM D 558. Perform additional moisture-density relationship tests once a month or whenever there is noticeable change in material gradation or plasticity.
- E. In-place density tests of compacted pipe foundation, embedment and trench zone backfill soil materials will be performed according to ASTM D 1556, or ASTM D 2922 and ASTM D 3017, and at following frequencies and conditions.
 - 1. For open cut construction projects and auger pits: Unless otherwise approved by Project Manager, successful compaction to be measured by one test per 40 linear feet measured along pipe for compacted embedment and two tests per 40 linear feet measured along pipe for compacted trench zone backfill material. Length of auger pits to be measured to arrive at 40 linear feet.
 - 2. A minimum of three density tests for each full shift of Work.
 - 3. Density tests will be distributed among placement areas. Placement areas are: foundation, outer bedding, haunching, initial backfill and trench zone.
 - 4. The number of tests will be increased if inspection determines that soil type or moisture content are not uniform or if compacting effort is variable and not considered sufficient to attain uniform density, as specified.

5. Density tests may be performed at various depths below fill surface by pit excavation. Material in previously placed lifts may therefore be subject to acceptance/rejection.
 6. Two verification tests will be performed adjacent to in-place tests showing density less than acceptance criteria. Placement will be rejected unless both verification tests show acceptable results.
 7. Recompacted placement will be retested at same frequency as first test series, including verification tests.
 8. Identify elevation of test with respect to natural ground or pavement.
- F. Recondition, re-compact, and retest at Contractor's expense if tests indicate Work does not meet specified compaction requirements. For hardened soil cement with nonconforming density, core and test for compressive strength at Contractor's expense.
- G. Acceptability of crushed rock compaction will be determined by inspection.
- 3.12 DISPOSAL OF EXCESS MATERIAL
- A. Dispose of excess materials in accordance with requirements of Section 01576 - Waste Material Disposal.

END OF SECTION

SECTION 33 1100
WATER DISTRIBUTION SYSTEMS

PART 1 - GENERAL

- 1.1 Section Includes
- A. Buried pipe and fitting.
 - B. Valves.
 - C. Fire hydrants.
 - D. Thrust blocks and harnessing.
 - E. Field quality control.
 - F. Test.
 - G. System disinfection.
 - H. Connections to existing mains.
- 1.2 Related Sections
- A. Trenching, bedding, and backfilling for pipelines are specified in Section 33 05 28 - Trenching and Backfilling for Utilities.
 - B. Coordinate the work of this Section with the work of Section 22 11 01 - Water Distribution
- 1.3 Measurement And Payment
- A. General: Measurement and payment for the water distribution system will be either by the lump- sum method or by the unit-price method as determined by the listing of the bid item for the water distribution system indicated in the Bid Schedule of the Bid Form.
 - B. Lump sum: If the Bid Schedule indicates a lump sum for the water distribution system, the lump- sum method of measurement and payment will be in accordance with Section 01 20 00 Price and Payment Procedures, Article 1.03.
 - C. Unit price: If the Bid Schedule indicates a unit price for the water distribution system, the unit- price method of measurement and payment will be as follows:
 - 1. Measurement:
 - a. Water distribution system will be measured for payment by the linear foot of pipe, installed in place, tested and disinfected, for each type and size of pipe, along the centerline of the pipe with deductions made for manholes or other structures, measured from the inside face of each structure.
 - b. Utility structures will be measured separately for payment as specified in Section 33 05 16, Utility Structures.

- c. Pipe fittings, valves, joints, pipe bedding, collar taps, and cutting of pipe will not be measured separately for payment, and all costs in connection therewith will be considered as included in the linear foot measurement for pipe.
 - d. Fire hydrants will be measured for payment by the individual unit (each), installed in place and acceptably tested.
 - e. Support of trench excavation, maintenance, support of existing utility facilities, grading, excavation and backfill, cast-in-place concrete, and incidental work pertaining to the installation of pipe will not be measured separately for payment, but will be considered as included in the linear foot measurement for pipe.
2. Payment: The water distribution system will be paid for at the indicated Contract unit prices for the computed quantities as determined by the measurement method specified in Article 1.03.C.1.

1.4 References

A. American Society for Testing and Materials (ASTM):

- 1. ASTM A126 Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
- 2. ASTM A197 Specification for Cupola Malleable Iron
- 3. ASTM A307 Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile
- 4. ASTM D1784 Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
- 5. ASTM D1785 Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
- 6. ASTM D2466 Specification for Poly (Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 40
- 7. ASTM D2564 Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
- 8. ASTM D2855 Practice for Making Solvent-Cemented Joints, with Poly (Vinyl Chloride) (PVC) Pipe and Fittings
- 9. ASTM D3139 Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
- 10. ASTM F439 Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
- 11. ASTM F477 Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

- B. American Water Works Association(AWWA):
1. AWWA C500 Gate Valve, 3 through 48 inches NPS – for Water and Sewage System
 2. AWWA C503 Standard for Wet-Barrel Fire Hydrants
 3. AWWA C504 Rubber Seated Butterfly Valve
 4. AWWA C508 Swing-Check Valves for Water Works Service, 2 inches through 24 inches NPS
 5. AWWA C606 Grooved and Shouldered Type Joints
 6. ANSI/AWWA Standard for Disinfecting Water Mains C651
 7. ANSI/AWWA Specification for Polyvinyl Chloride(PVC) Pressure Pipe, C900 4 in. through 12 in. for Water Distribution
- C. Water Utility District Standards: Note that all work shall be performed and completed in accordance with the jurisdictional water utility district's standard drawings and specifications. The Contractor shall be responsible for obtaining all such standards and for compliance with such standards as applicable.
- D. Underwriters Laboratories Inc. (UL):
1. UL 246 Hydrant for Fire-Protection Service
- 1.5 Submittals
- A. Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
 - B. Submit respective manufacturer's product data for manufactured materials and equipment, including all valves and fire hydrants.
 - C. Submit Shop Drawings showing piping layout and pipe, valves, hydrants, and locations of tie-ins, buttresses, and thrust blocks.
- 1.6 Submittals for Closeout
- A. General: Refer to Section 01 77 00 - Closeout Procedures, and Section 01 78 23 - Operation and Maintenance Data, for submittal requirements and procedures.
 - B. Record Drawings: Record actual location of piping mains, valves, connections, and invert elevations for review.
- 1.7 Site Conditions
- A. Excavations in which products will be buried shall be dry.
 - B. Coordinate the installation of the water supply system with the jurisdictional water utility owner.

- C. The jurisdictional water utility district shall provide water services to the water meters' points of connection for station facilities and landscape irrigation systems, and modifications to existing water mains, as indicated on the Contract Drawings. The Contractor shall be responsible for making all such arrangements.

PART 2 – PRODUCTS

2.1 Buried Pipe And Fittings

- A. Requirements: Provide the types, sizes, and configurations of pipe, fittings, and miscellaneous materials and installation accessories as indicated.
- B. PVC Pipe and Fittings, 3 Inches and Smaller:
1. Pipe: Polyvinyl chloride (PVC), ASTM D1785, Schedule 40 or 80, as indicated, Type I, Grade 1.
 2. Fittings: ASTM D2466, socket weld, same material and schedule as pipe, or meeting requirements of ASTM F439, as applicable.
 3. Joints: Socket welded with PVC solvent cement conforming to ASTM D2564 and ASTM D2855.

C. PVC Pipe and Fittings, 4 Inches and Larger:

1. Pipe: AWWA C900, Class 200, polyvinyl chloride (PVC) water pipe with bell and spigot ends and flexible ring joints.
2. Fittings: ASTM D1784, Type 1, Grade 1, polyvinyl chloride (PVC) fittings, Class 200, or meeting requirements of ASTM F439, as applicable.
3. Joints: ASTM D3139, gasketed bell joints with ASTM F477 gaskets.

2.2 Valves

A. Gate Valves:

1. Gate Valves up to 2-1/2 Inches: 150-pound bronze body, non-rising stem, single wedge, threaded connection.
2. Gate Valve 3 Inches and Over: AWWA C500, iron body, bronze trim, non-rising stem with square nut, single wedge, mechanical joint ends with type gland and serration's designed for plastic pipe service.

- B. Pressure Reducing Valves: All bronze construction, spring-loaded, single-seated, suitable for tight shutoff under dead-end conditions. Provide with renewable composition seat discs, nylon inserted diaphragm, bolted spring chamber, and threaded connection.

- C. Backflow Preventer: Provide a device that is approved by the jurisdictional water utility company. As a minimum, the backflow preventer shall be a reduced pressure principle assembly with two rising-stem gate shut-off valves, two resilient seat ball-valve test cocks, two check valves replaceable resilient disks and seat with relief valve with replaceable seat. Backflow preventer shall be suitable for 175 psig operating pressure and 140 degrees F operating temperature, and shall be of bronze construction with bronze internal parts and stainless steel springs, screwed inlet and outlet for 2-inch and smaller sizes, and cast iron, epoxy-coated construction with 150 pound flanged inlet and outlet for 3-inch and larger sizes.

2.3 Fire Hydrants

- A. Provide fire hydrants and related appurtenances as indicated. Fire hydrants shall comply with the requirements of the jurisdictional authority and the standard drawings and specifications of the jurisdictional water utility district, as applicable.
- B. Fire hydrants shall meet the requirements of AWWA C502 and UL 246, as applicable, and shall be wet barrel type, as a minimum, with a minimum of two discharge nozzles of size(s) required by the jurisdictional authority.

2.4 Concrete for Thrust Blocks

- A. Provide Class 3000, 1-inch aggregate, concrete for all thrust blocks, as specified in Section 03 05 15 - Portland Cement Concrete, with reinforcement where indicated.

2.5 Miscellaneous Metal

- A. Tie Rods: Stainless steel, Type 316, threaded ANSI standard, bolt threaded on both ends. Minimum 1/2-inch diameter for 4-inch pipe, 5/8-inch minimum diameter for 6-inch and 8-inch diameter pipe, and 3/4-inch minimum diameter for 12-inch and larger.
- B. Rod Couplings: Malleable iron, ASTM A197, turnbuckle design, female threaded to mate with tie rods, 5/8-inch and 3/4-inch sizes to mate with both rods and mechanical joint bolts.
- C. Pipe Clamps: For sizes 4 inches and larger, provide with malleable iron rod sockets. Provide washers in lieu of rod sockets where authorized, conforming with ASTM A126, Class A, cast iron. Bolts and bolting shall conform with ASTM A307.

PART 3 - EXECUTION

3.1 Maintaining Water Services

- A. Maintain water service and conduct operations at times selected to minimize the duration and inconvenience of service interruption.
- B. At least 24 hours prior to the required cutting or abandoning of an existing water main, notify the jurisdictional water utility owner, and obtain approval of the schedule. Actual cutting or abandoning of an existing water main shall be performed by the Contractor after receiving approval from the owner of the facility.
- C. Keep existing water mains parallel to new water mains in service until new water mains are ready for service.

- D. Where the existing water main or service is to be cut for connection to new piping, the work shall be performed by the Contractor. Initial work operations shall include the test-pitting of all points of connection (tie-in) to ensure the true location of existing linework.
- E. Water valves in service shall be operated only by personnel of the jurisdictional water utility owner.
- F. Except as specified otherwise herein, construction methods shall be in accordance with the applicable provisions of the jurisdictional water utility owner's standard drawings and specifications.

3.2 Installation

A. Installation Requirements:

1. Excavate pipe trench in accordance with Section 33 05 28 - Trenching and Backfilling for Utilities. Hand trim bottom of trench to approximately 6 inches below invert of pipe.
2. Top of pipe to finished grade shall be 30 inches unless otherwise indicated or approved by the Engineer.
3. Place sand bedding material, meeting the requirements of Section 33 05 28 - Trenching and Backfilling for Utilities, at trench bottom, level in one continuous layer not exceeding 8 inches in compacted depth. Compact bedding to 95 percent relative density.
4. Backfill around sides and to 6 inches above pipe with cover fill tamped in place and compacted to 95 percent relative density.
5. Test pipe distribution system and place tracer wire on top of pipe as specified herein prior to covering pipe. Backfill trench in accordance with Section 33 05 28 - Trenching and Backfilling for Utilities.
6. Maintain optimum moisture content of bedding material to attain required compaction density.
7. Provide concrete thrust blocks for elbows, tees, valves, and appurtenances of buried piping. Thrust blocks shall be constructed as indicated and in accordance with AWWA requirements.
8. Install piping true to line and grade, supported and guided to assure alignment under all conditions.
9. Install pipe to allow for expansion and contraction without stressing pipe or joints.
10. Install unions at each connection to valves, both sides of each valve.
11. Make change in line with fittings. Do not spring joints to effect change of direction.
12. Do not field cut pipe unless necessary. Make such necessary cuts by means of equipment designed for the purpose, ensuring a smooth and square end.
13. For connection to existing pipe, provide pipe with suitable ends or adapters, after verification of size and type of existing pipe.
14. Install tie rods and pipe clamps at every joint fitting and valve.

B. Valves:

1. Install valves in accordance with the valve manufacturer's installation instructions.
2. Where valves are provided by the jurisdictional water utility owner, provide suitable access for performance of suchwork.
3. Where necessary, alter the typical valve manhole to suit actual conditions. Any alterations in valve manholes shall be operable from the street level. All operator nuts shall be plumb to the valve manholes.
4. Set valve on solid bearing.
5. Center and plumb valve box over valve. Set box cover flush with finished grade.

C. Fire Hydrants:

1. Provide fire hydrant installations as indicated. Installation shall conform with requirements of the jurisdictional fire department and the water utility owner's standard drawings and specifications.
2. Provide necessary appurtenances and accessories as required to complete the installation.
3. Paint hydrants in accordance with applicable requirements of Section 09 91 00, Painting.
4. Set hydrants plumb, locate pumper nozzle perpendicular to and facing roadway.

D. Thrust Blocks and Harnessing:

1. Provide for counteracting thrust caused by static and dynamic forces, including water hammer at bends, tees, reducers, valves, and dead ends by installing harnessing as indicated or required. For other methods, submit details for approval of the jurisdictional water utility owner prior to use.
2. Provide concrete thrust blocks as indicated where harnessing is not practicable.

E. Water Service Connections: Provide water service connections, where necessary, in accordance with the California Plumbing Code, the installation instructions of the service pipe and fittings manufacturer, and the utility company requirements with reduced pressure back-flow preventer and water meter with by-pass valves.

F. Acceptance Requirements: After installation of pipes, ends of pipes shall be either capped or plugged. No piping shall be buried before being inspected and tested.

3.3 Field Quality Control

A. Refer to Section 01 43 00 - Quality Assurance, for requirements.

B. Compaction testing of related earthwork shall be performed in accordance with applicable requirements of Section 31 00 00 - Earthwork.

C. If tests indicate work does not meet specified requirements, remove such work, replace, and retest at no additional cost to the District.

- 3.4 Tests
- A. Protection from Flooding: Provide positive measures to protect exposed, installed pipe and compacted pipe bedding from flooding during testing.
- B. Notice of Testing:
1. Give 48 hours' notice of intention of testing to the jurisdictional water utility owner, which will furnish, install, and operate pumps, gages, meters, and individual pipe connections to test openings.
 2. Designate largest sections feasible for testing and sterilizing. Testing and sterilizing operations shall be performed by the Contractor, at Contractor's expense.
- C. Testing Requirements:
1. General:
 - a. Prior to backfilling, isolate the system by use of approved valves, caps and plugs, or other acceptable methods.
 - b. Maintain such isolation throughout the performance of leakage and pressure testing.
 - c. Where valves are used for isolation, eliminate leakage through such valves if it occurs. Maintain new work isolated from existing water mains, except for test connections, until testing and sterilization have been completed.
 2. Hydrostatic Tests:
 - a. For hydrostatic tests, provide approved caps and plugs in sections to be tested, and remove them after testing.
 - b. Prevent leakage in pipes and fittings at openings. Temporarily block plugged and capped ends to prevent displacement.
 - c. Install the water source connection for testing the isolated section. The Engineer may permit the use of a tap that will be furnished and installed by utility owner.
 - d. Provide labor and materials required for leakage testing, including excavation for installation and removal of pumps, gages, meters, and water source connections.
 - e. Where leakage exceeds the water utility company's standards, perform necessary corrective measures.
 - f. Remove and replace defective pipes, joints, fittings, valves, and other appurtenances. Reset such items if displaced.
 - g. Perform hydrostatic tests in accordance with the jurisdictional water utility district's requirements. All such tests shall be witnessed by the jurisdictional water utility district's representative. The Contractor shall be responsible for making all such arrangements.
 - h. Remove and replace defective pipe, joints, fittings, valves, and other appurtenances. Reset such items if displaced.

D. Testing and Flushing of Potable Water System: Test the potable water system hydrostatically in sections to a pressure of at least 150 psi for not less than 15 minutes, witnessed by the Engineer. Pressure test pipe before burial. Repair leaks and retest the system until the system is leak free. Use testing instruments calibrated by a qualified laboratory in accordance with Section 01 4500-Quality Control. Test sequence shall be as follows:

1. Lines shall be fully flushed.
2. Lines shall be hydrostatically tested.
3. Lines shall be fully flushed.
4. Lines shall be fully disinfected.

3.5 System Disinfection

A. Before final acceptance of the water supply system, each section of the new line shall be disinfected in accordance with ANSI/AWWA C651. One of the following sources of disinfectant shall be used:

1. Mixture of water and chlorine gas.
2. Direct application of chlorine.
3. Mixture of water and calcium hypochlorite; or
4. Mixture of water and calcium chloride.

B. Before disinfecting, flush the line thoroughly to remove dirt and extraneous materials. Clean each section of the line between valves independently.

C. Retain the disinfectant solution in the pipe for at least 24 hours. Following this sterilization period, the residual chlorine content at the ends of the section and at other representative points shall be not less than five parts per million. Then, the line shall be drained and thoroughly flushed with water until the residual chlorine content is similar to that obtained from the existing water distribution system.

D. Take water samples and test in accordance with ANSI/AWWA C651.

3.6 Connections to Existing Mains

A. Following testing and sterilization, new water distribution lines shall be connected to existing mains as indicated. Each connection shall be made at a time and in a manner that will result in the least interruption of service.

B. All connections involving shut down of jurisdictional water utility's existing facilities shall be made under the immediate supervision of the jurisdictional water utility district. No member of the Contractor's forces may operate any valve controlling the flow of water in the water utility's existing system.

C. The Contractor shall provide tie-ins to the existing system at a time that is convenient to jurisdictional water utility district, which may be in the evenings and on weekends.

END OF SECTION

**SECTION 33 1113
WATER LINES**

PART 1 – GENERAL

1.1 Section Includes

A. Requirements for installation of both small diameter water lines and large diameter water lines.

1. When specifications for large diameter water lines differ from those for small diameter water lines, large diameter specifications will govern for large diameter pipe.

1.2 Measurement and Payment

A. Unit Prices:

1. Payment for water lines installed by open-cut, augered with or without casing, aerial crossing, and pipe offset section on linear foot basis for each size of pipe installed. Separate pay items are used for each type of installation (open cut and auger) measured along the axis of the pipe and includes all restrained joint fittings and appurtenances.
2. When directed by Owner to install extra fittings, as required to avoid unforeseen obstacles, payment will be based on the following:
 - a. Extra fittings requested by the Owner and delivered to jobsite will be paid by the Owner.
 - b. Payment will include and be full compensation for items necessary for installation and operation of water line.

1.3 References

- A. ANSI A 21.11/AWWA C111 - Standard for Rubber-Gasket Joints for Ductile - Iron Pressure Pipe and Fittings.
- B. ANSI/NSF Standard 61 - Drinking Water System -Health Components.
- C. ASTM A 36 - Standard Specification for Carbon Structural Steel
- D. ASTM A 536 - Standard Specification for Ductile Iron Castings
- E. ASTM A 126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
- F. ASTM B 21 - Standard Specification for Naval Brass Rod, Bar, and Shapes.
- G. ASTM B 98 - Standard Specification for Copper-Silicon Alloy Rod, Bar, and Shapes.

- H. ASTM B 301 - Standard Specification for Free-Cutting Copper Rod and Bar.
- I. ASTM B 584 - Standard Specification for Copper Alloy Sand Casting for General Application.
- J. ASTM E 165 - Standard Test Method for Liquid Penetrant Examination.
- K. ASTM E 709 - Standard Guide for Magnetic Particle Examination
- L. ASTM F 1674 - Standard Test Method for Joint Restraint Products for Use with PVC Pipe.
- M. AWWA C 206 - Standard for Field Welding of Steel Water Pipe.
- N. AWWA C 207 - Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 Inches through 144 Inches.

1.4 Submittals

- A. Conform to requirements of Division 1 Specifications.
- B. Conform to submittal requirements of applicable Section for type of pipe used.
- C. Submit, a minimum of 15 calendar days before beginning pipe laying operations, layout drawing identifying proposed sections for disinfecting, hydrostatic testing and site restoration for entire project for review and approval. Layout drawing to identify sequence of sections for:
 - 1. Disinfection; not to exceed 2,000 linear feet per section.
 - 2. Hydrostatic testing and transfer of services; to immediately follow sequence of disinfected section.
 - 3. Site restoration; not to exceed limits specified; Sequence in order of disturbance.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 Preparation

- A. Conform to applicable installation specifications for types of pipe used.
- B. Employ workmen who are skilled and experienced in laying pipe of type and joint configuration being furnished. Provide watertight pipe and pipe joints.
- C. Lay pipe to lines and grades shown on Drawings. Use adequate surveying methods and equipment; employ personnel competent in use of equipment. Horizontal and vertical deviations from alignment as indicated on Drawings shall not exceed 0.10 feet. Measure

and record "as-built" horizontal alignment and vertical grade at maximum of every 50 feet on record drawings.

- D. For pipe diameters 36 inches and greater, clearly mark each section of pipe and fitting with a unique designation on the inside of pipe. Minimum letter height shall be 4 inches.
- E. Laying Large-Diameter Water Main:
 - 1. Lay not more than 200 feet of pipe in trench ahead of backfilling operations.
 - 2. Dig trench proper width as indicated. When operations cause trench width below top of pipe to become 4 feet wider than specified, install higher class pipe or improved bedding, as determined by Engineer. No additional payment will be made for higher class of pipe or improved bedding.
 - 3. Prevent damage to coating when placing backfill. Backfill material shall be free of large rocks or stones, or other material which could damage coatings.
 - 4. Before assembling couplings, lightly coat pipe ends and outside of gaskets with cup grease or liquid vegetable soap to facilitate installation. Groove pipe to manufacturer's specifications.
- F. Confirm that nine feet minimum separation from gravity sanitary sewers and manholes from potable waterline.
- G. Where above clearances cannot be attained, and special design has not been provided on Drawings, obtain direction from the City before proceeding with construction.
- H. Inform Owner if unmetered sprinkler or fire line connections exist which are not shown on Drawings. Make transfer only after approval by the City.
- I. City will handle, at no cost to Contractor, operations involving opening and closing valves for wet connections and for chlorination. Contractor is responsible for handling necessary installations and removal of chlorination and testing taps and risers.
- J. If asbestos-cement (A.C.) pipe is encountered, follow safety practices outlined in American Water Works Association's publication, "Work Practices for A/C Pipe". Strictly adhere to "recommended practices" contained in this publication and make them "mandatory practices" for this Project.
- K. For pipe diameters 36 inches and greater, clearly mark each section of pipe and fitting with unique designation on inside of pipe along with pressure class. Locate unique identifying mark minimum of five feet away from either end of each section of pipe. Provide one unique identifying mark in middle of each fitting. Place markings at consistent locations. Use permanent black paint and minimum letter height of 4 inches to mark designations.

- L. Contractor is responsible for assuring chosen manufacturer fulfills requirements for extra fittings and, therefore, is responsible for costs due to downtime if requirements are not met.

3.2 Handling, Cleaning and Inspection

A. Handling:

1. Place pipe along project site where storm water or other water will not enter or pass through pipe.
2. Load, transport, unload, and otherwise handle pipe and fittings to prevent damage of any kind. Handle and transport pipe with equipment designed, constructed and arranged to prevent damage to pipe, lining and coating. Do not permit bare chains, hooks, metal bars, or narrow skids or cradles to come in contact with coatings. Where required, provide pipe fittings with sufficient interior strutting or cross bracing to prevent deflection under their own weight.
3. Hoist pipe from trench side into trench by means of sling of smooth steel cable, canvas, leather, nylon or similar material.
4. For large diameter water lines, handle pipe only by means of sling of canvas, leather, nylon, or similar material. Sling shall be minimum 36 inches in width. Do not tear or wrinkle tape layers.
5. Use precautions to prevent injury to pipe, protective linings and coatings.
 - a. Package stacked pipe on timbers. Place protective pads under banding straps at time of packaging.
 - b. Pad fork trucks with carpet or other suitable material. Use nylon straps around pipe for lift when relocating pipe with crane or backhoe.
 - c. Do not lift pipe using hooks at each end of pipe.
 - d. Do not place debris, tools, clothing, or other materials on pipe.
6. Repair damage to pipe or protective lining and coating before final acceptance.
7. Reject pipe with visible cracks (not meeting exceptions) and remove from project site.

- B. Cleaning: Thoroughly clean and dry interior of pipe and fittings of foreign matter before installation, and keep interior clean until Work has been accepted. Keep joint contact surfaces clean until jointing is completed. Do not place debris, tools, clothing or other materials in pipe. After pipe laying and joining operations are completed, clean inside of pipe and remove debris.

- C. Inspection: Before installation, inspect each pipe and fitting for defects. Reject defective, damaged or unsound pipe and fittings and remove them from site.

3.3 Earthwork

- A. Conform to applicable provisions of Section 33 05 28 – Trenching and Backfill for Utilities.
- B. Bedding: Use bedding materials in conformance with Section 33 05 28 – Trenching and Backfill for Utilities
- C. Backfill: Use bank run sand or earth or native soil as specified in Section 33 05 28 – Trenching and Backfill for Utilities. Backfill excavated areas in same day excavated. When not possible, cover excavated areas using steel plates on paved areas and other protective measures elsewhere.
- D. Place material in uniform layers of prescribed maximum 8-inch loose lifts and wet or dry material to approximately optimum moisture content. Compact to prescribed density. Water tamping is not allowed.
- E. Pipe Embedment: Including 6-inch pipe bedding and backfill to 12 inches above top of pipe.

3.4 Pipe Cutting

- A. Cut pipe 12 inches and smaller with standard wheel pipe cutters. Cut pipe larger than 12 inches in manner approved by the City. Make cuts smooth and at right angles to axis of pipe. Bevel plain end with heavy file or grinder to remove sharp edges.

3.5 Piping Installation

- A. General Requirements: *(Notify City immediately upon encountering wet conditions!)*
 - 1. Lay pipe in subgrade free of water.
 - 2. Make adjustments of pipe to line and grade by scraping away subgrade or filling in with granular material.
 - 3. Properly form bedding to fully support bell without wedging or blocking up bell.
 - 4. Open Cut Construction: Keep pipe trenches free of water which might impair pipe laying operations. Grade pipe to provide uniform support along bottom of pipe. Excavate for bell holes after bottom has been graded and in advance of placing pipe. Lay not more than nominal city block length of not more than 300 feet of pipe in trench ahead of backfilling operations. Cover or backfill laid pipe if pipe laying operations are interrupted and during non-working hours. Place backfill carefully and simultaneously on each side of pipe to avoid lateral displacement of pipe and damage to joints. If adjustment of pipe is required after it has been laid, remove and re-lay as new pipe.
- B. Install pipe continuously and uninterrupted along each street on which work is to be performed. Obtain approval of the City prior to skipping any portion of Work.

- C. Protection of Pipeline: Securely place stoppers or bulkheads in openings and in end of line when construction is stopped temporarily and at end of each day's work.
- D. Perform Critical Location as shown on Drawings. Refer to Section 33 05 28 – Trenching and Backfill for Utilities.
- E. Laying Large Diameter, 24-inch or greater Water Line
 - 1. Lay not more than 200 feet of pipe (unless approved by the City) in trench ahead of backfilling operations.
 - 2. Dig trench proper width as shown. When trench width below top of pipe becomes 4 feet wider than specified, install higher class of pipe or improved bedding, as determined by the City. No additional payment will be made for higher class of pipe or improved bedding.
 - 3. Use adequate surveying methods and equipment; employ personnel competent in use of this equipment. Horizontal and vertical deviations from alignment as indicated on Drawings shall not exceed 0.10 feet. Measure and record "as-built" horizontal alignment and vertical grade at maximum of every 100 feet on record drawings.
 - 4. Prevent damage to coating when placing backfill. Use backfill material free of large rocks or stones (Maximum of 3-inch), or other material which could damage coatings.
 - 5. Before assembling couplings, lightly coat pipe ends and outside of gaskets with cup grease or liquid vegetable soap to facilitate installation.
 - 6. Prior to proceeding with critical tie-ins submit sequence of work based on findings from "critical location" effort.
- F. Perform following additional procedures when working on plant sites.
 - 1. Seventy-two hours prior to each plant shut down or connection, schedule coordination meeting with City personnel. At this meeting, present proposed sequencing of Work and verification of readiness to complete Work as required and within time permitted. Do not proceed with Work until the City agrees key personnel, equipment and materials are on hand to complete Work.
 - 2. Prior to fully excavating around existing piping, excavate as minimal as possible to confirm type and condition of existing joints. Verify size, type, and condition of pipe prior to ordering materials or fully mobilizing for Work.
 - 3. Do not proceed with connections to existing piping and identified critical stages of work unless approved by the City and the City's Utility Maintenance Division operator is present to observe.

4. Coordinate with City's Utility Department to obtain reduction in operating pressures prior to performing connections to existing piping.
 5. Make connections to existing piping only when two valves are closed off between connection and source of water pressure. Do not make connection relying solely on one valve, unless otherwise approved by the City.
 6. Perform critical stages of Work identified on Drawings at night or during low water demand months as specified in Division 1 specifications.
 7. Excavation equipment used on plant sites to have smooth bucket; no teeth or side cutters.
 8. Submit Lone Star Notification transmittal number to the City prior to beginning excavation.
 9. Before each "dig" with mechanical excavator, probe ground to determine potential obstructions. Repeat procedure until existing pipe is located or excavation reaches desired elevation. Perform excavations within one foot to existing piping by hand methods.
 10. Provide adequate notice to pipe manufacturer's representative when connecting or modifying existing prestressed or pretension concrete cylinder pipe.
 11. Provide field surveyed (horizontal and vertical elevations) "as-builts" of new construction and existing underground utilities encountered. Submit in accordance with Division 1 specifications.
- G. For tie-ins to existing water lines, provide necessary material on hand to facilitate connection prior to shutting down existing water lines. Provide the City a minimum of one week notice prior to shutting down existing water lines. All valves shall be operated by City staff only.

3.6 Joints and Jointing

- A. Rubber Gasketed Bell-and-Spigot Joints for Concrete Cylinder Pipe, Bar Wrapped Pipe PVC, Steel, and DIP:
1. Lubricate gaskets with nontoxic water-soluble lubricant before pipe units are joined.
 2. Fit pipe units together in manner to avoid twisting or otherwise displacing or damaging rubber gasket.
 3. After pipe sections are joined, check gaskets to ensure that no displacement of gasket has occurred. If displacement has occurred, remove pipe section and remake joint as for new pipe. Remove old gasket, inspect for damage and replace if necessary before remaking joint.

4. Where preventing movement is necessary due to thrust, use restrained joints as shown on Drawings.
 - a. Include buoyancy conditions for soil unit weight when computing thrust restraint calculations.
 - b. Do not include passive resistance of soil in thrust restraint calculations.
 5. Except for PVC pipe, provide means to prevent full engagement of spigot into bell as shown on Drawings. Means may consist of wedges or other types of stops as approved by Owner.
- B. Flanged Joints where required on Concrete Cylinder Pipe, Bar Wrapped Pipe, Ductile Iron Pipe, or Steel Pipe:
1. AWWA C 207. Prior to installation of bolts, accurately center and align flanged joints to prevent mechanical prestressing of flanges, pipe and equipment. Align bolt holes to straddle vertical, horizontal or north-south center line. Do not exceed 3/64 inch per foot inclination of flange face from true alignment.
 2. Use full-face gaskets for flanged joints. Provide 1/8-inch-thick cloth inserted rubber gasket material. Cut gaskets at factory to proper dimensions.
 3. Black nuts and bolts to match flange material. Use cadmium-plated steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Maintain at all times approximately same distance between two flanges at points around flanges. Tighten bolts alternately (180° apart) until all are evenly tight. Draw bolts tight to ensure proper seating of gaskets.
 4. Full length bolt isolating sleeves and washers shall be used with flanged connections.
 5. Furnish kits in accordance with Owner's "Approved Products List."
- C. Restrained Joints
1. Restrain pipe joints with Mega lugs or approved equal and concrete thrust blocks. Onsite mixing of concrete shall not be allowed. (Batch mix only).
 2. Thrust restraint lengths shown on Drawings are minimum anticipated lengths. These lengths are based on deflections indicated and on use of prestressed concrete cylinder pipe for large diameter lines and ductile iron pipe for small diameter lines. Adjustments in deflections or use of other pipe material may result in reduction or increase of thrust lengths. Perform calculations by pipe manufacturer to verify proposed thrust restraint lengths. Submit calculations for all pipe materials sealed by a Registered Professional Engineer in State of Texas for review by the City. Make adjustments in thrust restraint lengths at no additional cost to the City.

3. Passive resistance of soil will not be permitted in calculation of thrust restraint.
 4. Installation.
 - a. Install restrained joints mechanism in accordance with manufacturer's recommendations.
 - b. Examine and clean mechanism; remove dirt, debris and other foreign material.
 - c. Apply gasket and joint NSF 61 FDA food grade approved lubricant.
 - d. Verify gasket is evenly seated.
 - e. Do not over stab pipe into mechanism.
 5. Prevent any lateral movement of thrust restraints throughout pressure testing and operation. Place 3000 psi concrete for blocking at each bend, change in direction of existing water lines, to brace pipe against undisturbed trench walls. Finish placement of concrete blocking, made from Type I cement, 4 days prior to hydrostatic testing of pipeline. Test may be made two days after completion of blocking if Type II cement is used.
- D. Make curves and bends by deflecting joints or other method as recommended by manufacturer and approved by the City.
1. Deflection of pipe joints shall not exceed maximum deflection recommended by pipe manufacturer.
 2. If deflection is equal to or exceeds 5 percent from that specified, remove entire portion of deflected pipe section and install new pipe.
 3. Replace, repair, or reapply coatings and linings as required.
 4. Assessment of deflection may be measured by the City at location along pipe. Arithmetical averages of deflection or similar average measurement methods will not be deemed as meeting intent of standard.
 5. When rubber gasketed pipe is laid on curve, join pipe in straight alignment and then deflect to curved alignment.
- 3.7 Securing, Supporting and Anchoring
- A. Support piping as shown on Drawings and as specified in this Section, to maintain line and grade and prevent transfer of stress to adjacent structures.
 - B. Where shown on Drawings, anchor pipe fittings and bends installed on water line by welding consecutive joints of pipe together to distance each side of fitting. Restrained

length, as shown on Drawings, assumes that installation of pipe and subsequent hydrostatic testing begins upstream and proceed downstream, with respect to normal flow of water in pipe. If installation and testing differs from this assumption, submit for approval revised method of restraining pipe joints upstream and downstream of device used to test against (block valve, blind flange or dished head plug).

- C. Use adequate temporary blocking of fittings when making connections to distribution system and during hydrostatic tests. Use sufficient anchorage and blocking to resist stresses and forces encountered while tapping existing water line.

3.8 Polyethylene Wrap

- A. Double wrap ductile iron pipe and appurtenances (except fire hydrants and fusion bond or polyurethane coated fittings) with 8-mil polyethylene film.
- B. Do not use polyethylene wrap if pipe is cathodically protected.

3.9 Cleanup and Restoration

- A. Cleanup and restore site as directed by the City.

3.10 Cleaning Piping Systems

- A. Remove construction debris or foreign material and thoroughly broom clean and flush piping systems. Provide temporary connections, equipment and labor for cleaning. Owner must inspect water line for cleanliness prior to filling.

3.11 Disinfection of Water Lines

- A. Conform to TCEQ requirements for Disinfection of Water Utility Distribution.

3.12 Field Hydrostatic Tests

- A. Conform to requirements of Division 1 specifications.

END OF SECTION

**SECTION 33 1653
 TRAFFIC PAINT STRIPING**

PART 1 - REFLECTORIZED MULTIPOLYMER PAVEMENT MARKINGS

1. Description.

This Item shall govern to furnish, and place reflectORIZED multi-polymer pavement markings as shown on the plans.

2. Materials.

A. **Multi-Polymer Pavement Marking Materials.** Provide a prequalified multi-polymer resin material which is:

- toxic heavy metal free (lead, chromium, cadmium, and other toxic heavy metals as defined by the United States Environmental Protection Agency,)
- two-component (a predominantly multi-polymer pigmented resin component with a curing agent component),
- 100% solids, producing no toxic fumes when heated to application temperature,
- track-free in less than 40 minutes, and
- formulated and tested to perform as a pavement marking material with glass spheres applied to the surface.

Furnish in accordance with the requirements below.

**Table 1
 Color Requirements**

Federal 595 Color		Chromaticity Coordinates								Brightness (Y)
		1		2		3		4		
		x	y	x	y	x	y	x	y	
White	17855	.290	.315	.310	.295	.350	.340	.330	.360	60 min
Yellow	33538	.470	.455	.510	.489	.490	.432	.537	.462	30 min

**Table 2
 Physical Properties**

Property	Test Procedure	Min	Max
Abrasion Resistance, loss, 750±38µm film, 72 hr cure, CS17 wheel, 1000 g, 1000 cycles	ASTM C501		0.080 g
Hardness, Shore D	ASTM D 2240	75	
Adhesion, 375±38 µm film, 72 hr cure, 25C	ACI 503, Appendix A.1	Fail in Concrete	
Yellowness Index (White only), QUV, 375±38 µm film, 72 hr cure	ASTM 1925		30

Prequalify materials with the Construction Division, Materials and Pavements Section. To prequalify, supply:

- a test report showing proposed multi-polymer pavement marking materials meet the requirements above,
- a 1-quart sample of each component for specification verification, and
- documentation of acceptable performance from TxDOT pavement marking field applications that have been in place for at least 1 year or published documentation from the National Transportation Product Evaluation Program showing a minimum retro reflectivity readings along the skip lines of 250 mcd for white and 200mcd for yellow after one year.

Formulation changes require a new prequalification.

The material supplied to the project will be tested against the prequalification sample to assure that no formulation changes are made without notifying the Construction Division. The testing to characterize the project samples will include but not be limited by those requirements listed in Table 3. Tests to be run and allowable variations are:

Table 3 Material Requirements

Tests	Requirements
Density (Gallon Weight)	±0.10 lb./gal
Viscosity (Krebs-Stormer)	±7 KU
Viscosity (Cone & Plate)	±0.5 Poises
Grind	Not Less than the Standard
% Non-Volatile Matter	±1.0%
% Pigment (white)	±3.0 %
% Volume Non-Volatile Matter	±3.0%
Infrared Spectrum	Match Standard

Provide certified test results for project materials prior to the start of the project.

- B. **Glass Traffic Beads.** Furnish Type II or Type III drop-on glass beads conforming to DMS-8290, “Glass Traffic Beads.” Use Type II beads only as a part of a double drop system with Type III beads. For double drop systems, dispense each type bead with a separate dispenser system, with the ratio of Type II beads not greater than 50% by weight of the beads used.
- C. **Labeling.** Use clearly marked containers that indicate color, mass, material type, manufacturer, and batch number.
3. Equipment.
- A. **General Requirements.** Use equipment which:
- is maintained in satisfactory condition,
 - meets or exceeds the requirements of the National Board of Fire Underwriters and Texas Railroad Commission for this application,
 - uses an automatic bead dispenser attached to the pavement marking equipment, and
 - can provide continuous mixing and agitation of the pavement marking material.
- B. **Material Placement Requirements.** Use equipment which can place:
- at least 40,000 ft. of 4-in. solid or broken markings per day at the specified thickness.
 - linear markings up to 8 in. wide in a single pass.

- markings other than solid or broken lines.
 - a center-line and no-passing barrier-line configuration consisting of 1 broken line with 2 solid lines, at the same time, to the alignment, spacing, and thickness shown on the plans, for 3- line application;
 - white line from both sides;
 - lines with clean edges, uniform cross-section and thickness and reasonably square ends;
 - skip lines between 10 and 10-1/2 ft., an approximate stripe-to-gap ratio of 1 to 3, and a stripe– gap cycle between 39-1/2 ft. and 40-1/2 ft., automatically;
 - beads uniformly and almost instantly upon the marking as the marking is being applied;
 - beads uniformly during the application of 2 adjacent lines. Each line must have an equivalent bead yield rate and embedment;
 - each component within the component mix tolerances recommended by the manufacturer.
4. CONSTRUCTION. Place markings prior to opening to traffic unless short term or work zone markings are allowed.
- (1) **General.** Obtain approval for the sequence of work and estimated daily production. On roadways already open to traffic, place markings with minimum interference to the operations of that roadway. Use traffic control as shown on the plans or as approved. Protect all markings placed under open-traffic conditions from traffic damage and disfigurement.

Establish guides to mark the lateral location of pavement markings as shown on the plans or as directed and have guide locations verified. Use material for guides that will not leave a permanent mark on the roadway.

Apply markings on pavement that is completely dry and meets all temperature and humidity requirements of the manufacturer: Apply markings:

- using widths, colors, and at locations shown on the plans;
- in proper alignment with the guides without deviating from the alignment more than 1 in. per 200 ft. of roadway or more than 2 in. maximum;
- free of blisters and with no more than 5%, by area, holes or voids;
- with uniform cross section and thickness;
- with clean and reasonably square ends;
- which harden properly with no tackiness;
- using personnel skilled and experienced with installation of pavement markings;
- which are reflectorized; and
- that meet requirements in Test Method Tex-828-B.

Remove all applied markings that are not in alignment or sequence as stated in the plans or as stated in the specifications at the Contractor's expense in accordance with Item 677, "Eliminating Existing Pavement Markings and Markers," except for measurement and payment.

(2) **Surface Preparation.**

- (a) Surface preparation methods should be determined by the manufacturer and be in accordance to Item 678.
- (b) Cleaning for Asphalt Surfaces Younger Than 3 Years, Old Hydraulic Concrete Surfaces and All Retracing. Air-blast or broom old hydraulic cement concrete surfaces and all asphalt surfaces to remove loose material, unless otherwise shown on the plans.
- (c) Cleaning for Asphalt Surfaces Older than 3 Years and New Hydraulic Concrete

(No Existing Markings). Clean in accordance with Item 678, "Pavement Surface Preparation for Markings," to remove curing membrane, dirt, grease, loose and flaking existing construction markings, and other forms of contamination.

- (3) **Application.** Apply markings during good weather unless otherwise directed. If markings are placed at Contractor option when inclement weather is impending and the markings are damaged by subsequent precipitation, the Contractor is responsible for all costs associated with replacing the markings if required.

Adding thinner to the coating is not allowed.
Apply on surfaces with a minimum surface temperature of 50°F.

- (4) **Performance Requirements.** All markings and replacement markings must meet the requirements of this Item for at least 15 calendar days after installation. Remove pavement markings that fail to meet requirements and replace at the Contractor's expense unless otherwise directed. Replace all failing markings within 30 days of notification.

If the material does not cure properly, remains soft and tacky, or discolors and the Engineer requires removal, at least 90% of the material must be removed by approved methods before restriping will be allowed.

Conduct visual inspections and instrument evaluations of placed pavement markings.

- (a) **Visual Inspections.** Conduct a visual inspection of the stripe placement according to Tex-828-B, "Determining Functional Characteristics of Pavement Markings." Conduct reviews during dry off-peak traffic periods without closing any lanes. Conduct the inspection within 7 days after the stripe has been placed. A department's designated representative will be present for the inspection.
- (b) **Instrument Evaluations.** Conduct instrument evaluations in areas as directed by the Engineer. For edge line markings; center-line/no passing barrier-line; and lane lines; meet the following initial minimum retro reflectivity values when measured between 5 and 15 days after application:

White markings: 250 millicandelas per square meter per lux

(mcd/m²lux) Yellow markings: 200 mcd/m²lux

Make all measurements in the direction of traffic flow, except for broken centerline on two-way roadways, where measurements will be made in both directions.

Provide a portable retro reflectometer, which uses 30-meter geometry meeting the requirements described in ASTM E 1710.

Provide a report to the Engineer of all readings taken and their approximate locations.

The Contractor is responsible for traffic control when making initial retroreflectivity measurements.

At locations approved by the Engineer, take a minimum of 1 measurement every mile on each series of markings (i.e. edge-line, center skip line, each line of a double line...etc.). If more than one measurement is taken, the measurements will be averaged. For all markings measured in both directions, take a minimum of 1 measurement in each direction.

If the measurement taken on a specific series of markings within each mile segment falls below the initial minimum retroreflectivity values, take a minimum of 5 more measure

ments within that mile segment for that series of marking. If the average of these 5 measurements falls below the initial minimum retroreflectivity requirements, that mile segment of the applied markings is considered unacceptable. Restripe any unacceptable segments until initial minimum retroreflectivity requirements are met.

- (5) **Warranty.** Before application of pavement markings, provide TxDOT a warranty by the Manufacturer that the Manufacturer will replace, at no cost to the department, except as noted below, any materials which fail to meet the warranty performance requirements as listed in this specification for 3 years from the date the portion of the facility containing those markings becomes operational.

If the markings fail to meet the requirements of Special Specification 1653, the manufacturer will provide the replacement materials and labor that will restore the pavement marking retroreflectivity values to warranty levels or greater.

- (a) **Warranty Performance Requirements.** Pavement markings will meet the following performance requirements for the warranted life of the materials.

Reflectivity. When measured at 30-meter geometry, maintain a minimum retroreflectivity value of:

- White markings: 150 mcd/m²lux.
- Yellow markings: 125 mcd/m²lux.

Durability. Pavement markings will maintain the color (daytime and nighttime reflected), length, width, shape, and configuration shown on the plans. Nighttime and daytime color will be essentially the same color as the standard maintained by the department's Construction Division, Materials Section.

Deviations in length, width, shape, or configuration caused by, in the Engineer's opinion, pavement failure will not be considered as a failure of the pavement markings.

- (b) **Reflectivity Determination.** The following procedures will be used to determine the performance of pavement markings for warranty purposes. Periodic visual night inspection will be made by TxDOT as described by TxDOT Test Method TEX-828-B, when deemed necessary by the Engineer. The Manufacturer's representative may accompany the Engineer on a subsequent inspection when pavement markings do not appear to meet minimum retroreflectivity or nighttime color requirements. All retroreflectivity measurements shall be made on a clean, dry surface at a minimum temperature of 40°F. The average retroreflectivity value for the Measurement Zone shall be used to determine if the minimum performance values have been met.

Longitudinal Markings. A Measurement Zone shall consist of either edge lines, center lines, or lane lines, but not in combination. Random sampling techniques shall be used to determine the average reflectivity throughout the zone.

- (c) **Replacement.** Pavement markings that do not meet the warranty performance requirements will be replaced by the Manufacturer normally within 15 days unless weather conditions or other conditions as approved by the Engineer dictate otherwise, but not more than 90 days. Notification will be by mail, return receipt requested, to an address as specified by the Manufacturer as indicated on the warranty.

The Manufacturer will be responsible for application, at no cost to the department, of all replacement materials covered by the warranty.

- (d) **Exclusions.** Up to 5% of the markings on any project may at the discretion of the Engineer, be excluded from the replacement provisions provided that the failure is a result of outside

causes rather than defective material as determined by the Engineer. Outside causes include, without limitation: Extreme wear at intersections or crossover areas, unusually large amounts of heavy vehicles. Outside causes exclude, without limitation: Linear, free rolling traffic regardless of ADT.

Pavement markings damaged by snow or ice removal operations or other natural occurrences such as flooding, earthquakes, or landslides are exempt from warranty.

5. **Measurement.** This Item will be measured by the foot; by each word, symbol, or shape; or by any other unit shown on the plans. Each stripe will be measured separately.

This is a plans quantity measurement Item. The quantity to be paid is the quantity shown in the proposal unless modified by Article 9.8, "Plans Quantity Measurement." Additional measurements or calculations will be made if adjustments of quantities are required.

6. **Payment.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Reflectorized Multipolymer Pavement Markings" of the types and colors, shape, width, size, and thickness as applicable. This price will be full compensation for materials, application of pavement markings, equipment, labor, tools, and incidentals.

Surface preparation, when shown on the plans, will be paid for under Item 678, "Pavement Surface Preparation for Markings."

When replacement markings are required due to damage to the original markings from precipitation, and the original markings were placed at the direction of the Department, the plans quantity requirements under "Measurement" do not apply to the original and replacement markings. The Contractor will be paid for the actual quantity of original and replacement markings at the unit price bid for that bid item.

END OF SECTION

**SECTION 33 3100
SANITARY UTILITY SEWERAGE PIPING**

PART 1 – GENERAL

SECTION INCLUDES

- A. Buried Pipe and Fittings
- B. Cleanouts
- C. Sewage Ejector
- D. Field Quality Control

1.01 Related Sections

- A. Section 01 33 00 - Submittal Procedures
- B. Section 01 33 23 - Shop Drawings, Product Data, and Samples
- C. Section 01 45 00 – Quality Control
- D. Section 01 77 00 – Closeout Procedures
- E. Section 01 78 23 – Operation and Maintenance Data
- F. Section 01 78 39 – Project Record Documents
- G. Section 22 13 01 – Sanitary Sewerage
- H. Section 22 14 29 – Water Distribution
- I. Section 31 00 00 – Earthwork
- J. Section 33 05 16 – Utility Structures
- K. Section 33 05 28 – Trenching and Backfilling for Utilities

1.02 Measurement And Payment

- A. General: Measurement and payment for the site sanitary sewerage system will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for the site sanitary sewerage system indicated in the Bid Schedule of the Bid Form.
- B. Lump Sum: If the Bid Schedule indicates a lump sum for the site sanitary sewerage system, the lump-sum method of measurement and payment will be in accordance with Section 01 20 00 - Price and Payment Procedures, under Article entitled “Lump-Sum Measurement”.
- C. Unit Price: If the Bid Schedule indicates a unit price for the site sanitary sewerage system, the unit-price method of measurement and payment will be as follows:

1.Measurement:

- a. Site sanitary sewerage system will be measured for payment by the linear foot of pipe, installed in place and tested, for each type and size, along the centerline of the pipe, with deductions made for manholes or other structures, measured from the inside face of each structure.
- b. Utility structures will be measured separately for payment as specified in Section 33 05 16 - Utility Structures.
- c. Pipe fittings, joints, pipe bedding, cleanouts, collar taps, and cutting of pipe will not be measured separately for payment, and all costs in connection therewith will be considered as included in the linear foot measurement for pipe.
- d. Support of trench excavation, maintenance, support of existing utility facilities, excavation and backfill, concrete, and incidental work pertaining to the installation of sewer pipe will not be measured separately for payment, but will be considered as included in the linear foot measurement for sewer pipe.

2. Payment: Site sanitary sewerage system will be paid for at the indicated Contract unit prices for the computed quantities as determined by the measurement method specified in Article 1.03.C.1.

1.03 References

A. American National Standards Institute (ANSI):

1. ANSI A21.11 Rubber Gasket Joints for Cast Iron and Ductile Iron Pressure Pipe and Fittings

B. American Society for Testing and Materials (ASTM):

1. ASTM A74 Specification for Cast Iron Soil Pipe and Fittings

2. ASTM C12 Practice for Installing Vitrified Clay Pipe Lines

3. ASTM C14 Specification for Concrete Sewer, Storm Drain, and Culvert Pipe

4. ASTM C76 Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

5. ASTM C425 Specification for Compression Joints for Vitrified Clay Pipe and Fittings

6. ASTM C443 Specification for Joints for Circular Concrete Sewer and Culvert Pipe, using Rubber Gaskets

7. ASTM C564 Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings

8. ASTM C700 Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated

9. ASTM D1785 Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
10. ASTM C2321 Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe
11. ASTM D2466 Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings, Schedule 40
12. ASTM D2564 Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) plastic Pipe and Fittings
13. ASTM D2565 Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, Vent Pipe, and Fittings
14. ASTM D2729 Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
15. ASTM D2855 Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings
16. ASTM D3139 Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
17. ASTM F477 Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

C. American Water Works Association (AWWA):

1. ANSI/ Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch AWWA C900 through 12 inches for Water Distribution

D. Sanitary Utility District Standards: Note that all work shall be performed and completed in accordance with the jurisdictional sanitary utility district's standard drawings and specifications. The Contractor shall be responsible for obtaining all such standards and for compliance with such standards as applicable.

1.04 Submittals

- A. Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Submit Shop Drawings showing piping layouts, sizes, types, cleanouts, and the sewage structure ejector station.
- C. Submit the respective manufacturers' product data for manufactured materials and equipment.
- D. Submit equipment manufacturer's printed operating and maintenance instructions in accordance with Section 01 78 23 - Operation and Maintenance Data, consisting of a detailed parts list, a recommended spare parts list, and complete operation and maintenance procedures.
- E. Submit certified test reports of equipment, as applicable.

1.05 Submittals For Closeout

- A. Refer to Section 01 77 00 - Closeout Procedures, and Section 01 78 39 - Project Record Documents, for submittal requirements and procedures.
 - B. Record actual location of piping mains, valves, connections, thrust restraints, and invert elevations.
- 1.06 Site Conditions

- A. Excavations shall be dry immediately before and after products are installed. Provide surfaces and structures to, and on which sewerage products will be installed.
- B. Coordinate the installation of the sanitary sewerage system with the jurisdictional sanitary district or utility owner.

PART 2 - PRODUCTS

2.01 Buried Pipe And Fittings

- A. Requirements: Provide the types, sizes, and configurations of pipe, fittings, and miscellaneous materials and installation accessories as indicated and required. Pipe ends shall be bell and spigot, except plain end pipe shall be joined with mechanical clamp and gasket joint.

B. PVC Pipe and Fittings, 3 Inches and Smaller:

- 1. Pipe: Polyvinyl chloride (PVC), conforming with ASTM D1785, Schedule 40 or 80, as indicated, Type I, Grade 1, bell and spigot style solvent sealed jointed.
- 2. Fittings: ASTM D2466, Socket Weld, same material and schedule as pipe.
- 3. Joints: Socket welded with PVC solvent cement conforming with ASTM D2564 and ASTM D2855.

C. PVC Pipe and Fittings, 4 Inches and Larger:

- 1. Pipe: AWWA C900, Class 200, Poly (Vinyl Chloride) (PVC) Water Pipe with Bell and Spigot Ends and Flexible Ring Joints.
- 2. Fittings: ASTM D2466, Type 1, Grade 1, Poly (Vinyl Chloride) (PVC) Fittings, Class 200.
- 3. Joints: ASTM D3139 gasketed bell joints with ASTM F477 gaskets.

D. Cast Iron Soil Pipe:

- 1. Pipe: ASTM A74.
- 2. Joint Devices: ASTM C564 or ANSI A21.11, rubber gasket joint devices, as applicable.

E. Clay Pipe:

1. Pipe: ASTM C700, unperforated.
2. Joint Device: ASTM C425, compression joint.

F. Concrete Pipe:

1. ASTM C14, Class 3, unreinforced.
2. Joint Device: ASTM C443, rubber compression gasket joint.

G. Reinforced Concrete Pipe:

1. Pipe: ASTM C76, Class III, with steel reinforcement.
2. Joint Device: ASTM C443, rubber compression gasket joint

H. Pipe Accessories:

1. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, with neoprene ribbed gasket for positive seal.
2. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers traps, and other configurations as indicated or required.

I. Pipe Bedding Material: Clean sand as specified in Section 33 05 28 - Trenching and Backfilling for Utilities.

2.02 Cleanouts

- A. At grade cleanouts shall have an adjustable sleeve-type housing, a threaded brass plug with countersunk slot, and cast-iron frame and cover.

2.03 Sewage Ejector

- A. Provide in accordance with applicable requirements of Section 22 14 29 - Sump Pumps.

PART 3 - EXECUTION

3.01 Examination

- A. Verify that trench cut excavation base is ready to receive work and that excavations, dimensions, and elevations are as indicated.

3.02 Preparation

- A. Excavations shall be free of water and extraneous material immediately before sanitary sewerage products are installed or placed. Bottoms of trenches shall have a 6-inch sand bed and shall be formed to support the bottom quadrant of the pipe and fittings. Should rock be encountered or should bedding material be unsuitable to support the products at design elevation, continue excavation to an elevation 8 inches below the design elevation and backfill with clean sand.
- B. Hand trim excavations to required elevation.

- C. Remove large stones or other hard matter that could damage pipe or impede consistent backfilling and compacting operations.
- D. Interior of pipe, pipe fittings, valves, drains, and cleanouts shall be cleaned of foreign substances before installation.

3.03 Installation Requirements

- A. Excavate pipe trench in accordance with Section 33 05 28 - Trenching and Backfilling for Utilities. Hand-trim bottom of trench to approximately 6 inches below invert of pipe.
- B. Top of pipe to finished grade shall be 30 inches unless otherwise indicated or approved by the Engineer.
- C. Place sand bedding material meeting the requirements of Section 33 05 28 - Trenching and Backfilling for Utilities, at trench bottom, level in one continuous layer not exceeding 8 inches in compacted depth. Compact bedding to 95 percent relative density.
- D. Backfill around sides and to 6 inches above pipe with cover fill tamped in place and compacted to 95 percent relative density.
- E. Test pipe distribution system and place tracer wire on top of pipe as specified herein prior to covering pipe. Backfill trench in accordance with Section 33 05 28 - Trenching and Backfilling for Utilities.
- F. Maintain optimum moisture content of bedding material to attain required compaction density.
- G. Install products where indicated. Remove and reinstall products that are disturbed after installation. Ends of products to which future connections will be made shall be either valved, or properly plugged, capped, and anchored.
- H. Connections to existing facilities shall be made with fittings and short bends to suit the actual conditions. Connect products in accordance with the product manufacturer's installation instructions.
- I. Pipe and fittings shall be set to line and grade before joints are made up. Angular deflections of joints shall not exceed the recommendations of the pipe and fitting manufacturer. Should the alignment require deflection of joints to be in excess of those recommended, use special bends to achieve the indicated deflection. Pipe ends and joints shall be prepared in accordance with the manufacturer's recommendations. As a minimum, pipe ends shall be sanded and cleaned, fittings shall be cleaned, and solvent shall be applied to both pipe and fittings.
- J. Install pipe, fittings, and accessories in accordance with ASTM C12, ASTM D2321, and the manufacturer's instructions. Seal joints water tight.
- K. Lay pipe to slope gradients as indicated.
- L. Install bedding at sides and over top of pipe to minimum compacted thickness of 12 inches, compacted to 95 percent relative density.

3.04 Installing Pipe

- A. Protect pipe and fittings during handling to prevent damage.
- B. Place, shape, and compact bedding material to receive barrel of pipe.

- C. Start laying pipe at the lowest point; lay true to line and grade indicated.
- D. Install pipe to bear on bedding material along its entire length.
- E. Do not place the pipe on blocking material of any type.
- F. Do not use wedges while installing the pipe.
- G. Install pipe so that bells and grooves are on the upstream end.
- H. Align each section of pipe with adjoining section leaving a uniform annular space between the bell and spigot to prevent sudden offsets in flow line.
- I. As each section of pipe is laid, place sufficient bedding and backfill to hold it firmly in place.
- J. Apply lubricant to rubber gasket (O-rings) immediately before joining pipe sections.
- K. Keep interior of sewer clean as work progresses. Where small pipe sizes make cleaning difficult, keep a suitable swab and pulling line in the pipe, and pull through each joint immediately after jointing is completed.
- L. Keep trenches and excavations dry and free of water during construction and until backfilling and compaction are completed.
- M. When work is not in progress, securely plug ends of pipe and fittings to prevent extraneous matter from entering pipes and fittings.
- N. Cut pipe ends, which project into a sewer structure, flush with the inside face of the structure and cover exposed pipe reinforcement with grout.
- O. Where length of stub is not indicated, install a 4-foot length, and seal the free end with brick masonry bulkhead or an approved stopper.
- P. Obtain the Engineer's approval before covering pipe.
- Q. Where indicated, place additional bedding material around and over the pipe in lifts not exceeding 6 inches before compaction. Compact each lift before placement of the next lift.
- R. Accomplish compaction by methods that will avoid damage to pipe and will not disturb its alignment and grade. The use of vibratory rollers is prohibited until compacted cover over pipe has reached 3 feet or half the pipe diameter; whichever is greater.
- S. Connect sanitary sewerage system to existing public sanitary sewers in accordance with requirements of the jurisdictional authority.

3.05 Pipe Cleanouts

- A. Installation: Cleanouts shall be the same size as the pipe, with 4-inch diameter as a minimum. Cleanouts for drainage pipe shall consist of a long sweep 1/4 bend, or one or two 1/8 bends extended to the location indicated. Wall or accessible piping cleanouts shall be T-pattern, 90 degree branch drainage fittings having screw plugs. Cleanouts shall be provided at the base of each riser and shall consist of a wye pattern fitting with a screw plug.

- B. Form and place cast-in-place concrete pad with provision for sanitary sewer pipe ends.
- C. Establish elevations and invert for inlets and outlets.
- D. Mount cleanout surface hub level in grout to elevation indicated.

3.06 Field Quality Control

A. Requirements:

1. Refer to Section 01 45 00 - Quality Control, for field inspection and testing requirements.
2. Where drainage piping is located below invert slabs, conduct a ball, shuttlecock, or mandrel test to ensure that the line is free of obstructions subsequent to the placing of pervious backfill material over the line and prior to the placement of the concrete invert slab.
3. Upon completion of the test and determination that the line is free of obstructions, plug, cap, or otherwise close the open end or ends of the installed piping to prevent the entrance of debris into the lines.
4. Immediately prior to final inspection of the work, remove debris from manholes, drain inlets, and floor scupper drains. In the presence of the jurisdictional sanitary utility owner's representative prove by one of the methods specified above that the piping is free of obstructions.
5. The Contractor shall be responsible for making all necessary arrangements with the jurisdictional sanitary utility owner for performing and witnessing the required tests.
6. Request inspection of exposed piping prior to placing backfill.
7. Compaction testing of related earthwork shall be performed in accordance with applicable requirements of Section 31 00 00 - Earthwork.
8. If tests indicate work does not meet requirements, remove such work, replace, and retest at no additional cost to the District.

B. Sanitary Pipeline Tests:

1. Perform air tests on all installed sanitary sewer pipes upon completion of backfill.
2. Hydrostatically test all installed sanitary sewer force mains.
3. Test all manholes for infiltration or exfiltration.
4. Test pipe sections by the exfiltration test.
5. Test sewer 24 inches or less in diameter with low pressure.
6. Sewers with a diameter greater than 24 inches may be tested by visual inspection.

C. Exfiltration Test:

1. Tightly plug end of pipe at downstream manhole.
2. Fill sewer, at either upstream manhole or standpipe, with water.
3. Allow water to stand for not less than eight hours, and until pipe has become saturated. Refill manhole or pipe to measuring mark and begin test.
4. Exfiltration will be determined as follows:
 - a. If standpipe has been filled, maintain a head of water not less than 2 feet nor more than 15 feet above highest point in the line being tested.
 - 1) Exfiltration: that volume of water added to standpipe during a 20-hour period.
 - b. If upstream manhole has been filled, measure original water elevation and, after 20 hours, final water elevation. Convert difference in elevation to gallons. Head of water shall be not less than 2 feet above highest point in the line being tested or not less than 2 feet above existing groundwater table, whichever is greater.
 - 1) Exfiltration: that volume of water calculated from the difference in elevations during a 20-hour period.
5. Allowable leakage:
 - a. Not more than 200 gallons per 24 hours per diameter inch per mile of sewer.
 - b. If leakage exceeds permissible loss, sewer section will not be accepted.
 - c. Do not conduct another exfiltration test until conditions of groundwater surrounding pipe return to a condition similar to those existing at beginning of test period.

D. Infiltration Test:

1. Tightly plug end of pipe at upstream manhole.
2. Install a 90-degree notch weir in downstream manhole.
3. Allow water to accumulate behind weir until overflow is constant.
4. Allowable leakage:
 - a. Not more than 200 gallons per 24 hours per diameter inch per mile of sewer.
 - b. If measured infiltration is more than the allowable rate, sewer section will not be accepted.

E. Low-Pressure Air Test:

1. Clean and set sections of pipe to be tested before starting air test.
2. Plug pipe outlets with pneumatic plugs capable of resisting internal testing pressures without requiring external bracing.
3. Immediately following pipe cleaning and wetting, slowly supply air to plugged pipe until internal air pressure reaches 4 psi. Allow at least two minutes for temperature to stabilize before proceeding, except slowly add air to maintain a 3.5 psig to 4 psig pressure. While temperature is stabilizing, spray plugs, pipes, and hoses with soap solution and eliminate air leaks.
4. After temperature has stabilized, measure time required for pressure to drop from 3.5 psig to 2.5 psig. If measured time exceeds allowable time, pipe will not be accepted.
5. Time, in seconds, for pressure to drop from 3.5 to 2.5 psig shall be not less than the following: time for intermediate lengths shall be interpolated:

Pipe (Ft)	Length of Pipe Diameter in Inches						
	8	10	12	15	18	21	24
25	18	28	40	62	89	121	158
50	35	55	79	126	178	243	317
75	53	83	119	186	267	364	475
100	70	110	158	248	356	485	634
125	83	38	198	309	444	595	680
150	100	165	238	375	510	595	680
175	123	193	277	425	510	595	680
200	141	120	317	425	510	595	680
225	158	248	340	425	510	595	680
250	176	275	340	425	510	595	680

- F. Visual Test Method: Slowly pull a television camera through sewer and inspect for visual leaks and cracks in pipe. Repair leaks, then re-inspect pipe.
- G. Joint Pressure Testing:
 1. Insert sealing packer with joint testing capability, into sewer line.
 2. Place sealing packer around joint and pressure test joint. If a drop in air pressure occurs, reseal the joint.
 3. Repeat procedure for each joint.
- H. Criteria for Acceptance: The section of sewer being tested will not be accepted if test results exceed allowable leakage or take less time than minimum holding time. If pipe proves to be unacceptable, immediately repair defective materials and installation. The Contractor will not be permitted to change to another test if original test method reveals system has failed.

I. Obstruction Tests:

1. Perform field tests to verify that installed sanitary systems are free from obstructions.
2. Remove obstructions by excavating at the apparent obstruction and repairing or replacing the defective pipe.

END OF SECTION

**SECTION 33 4100
STORM SEWAGE SYSTEM**

PART 1 – GENERAL

1.1 Description

- A. This Section specifies the requirements for providing storm sewers and appurtenant structures.

1.2 Quality Assurance

- A. Reference Standards Applicable to this Section

1. AASHTO: American Association of State Highway and Transportation Officials
 - a. M 36: Specification for Metallic (Zinc or Aluminum) Coated Corrugated Steel Culverts and Underdrains.
 - b. M 190: Specification for Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches.
 - c. M 252: Specification for Corrugated Polyethylene Drainage Tubing.
 - d. M 294: Specification for Corrugated Polyethylene Pipe 12 inch to 36-inch diameter.
2. ASTM: American Society for Testing and Materials
 - a. A 48: Specification for Gray Iron Castings.
 - b. A 74: Specification for Cast Iron Soil Pipe and Fittings.
 - c. C 40: Test Method for Organic Impurities in Fine Aggregate for Concrete.
 - d. C 76: Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.
 - e. C 150: Specification for Portland Cement.
 - f. C 443: Joints for Circular Concrete Sewer and Culvert Pipe Using Rubber Gaskets.
 - g. C 881: Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
 - h. D 618: Conditioning Plastics and Electrical Insulating Materials for Testing.
 - i. D 1248: Polyethylene Plastics Molding and Extrusion Material.
 - j. D 1693: Environmental Stress Cracking of Ethylene Plastics.
 - k. D 1785: Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 - l. D 2239: Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.

- m. D 2412: Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
- o. D 2447: Specifications for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.
- p. D 2466: Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
- q. D 2467: Socket Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
- r. D 2564: Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
- s. D 2665: Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings.
- t. D 2729: Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- u. D 2855: Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
- v. D 3035: Specifications for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter.
- w. D 3212: Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
- x. D 3261: Specification for Butt Heat Fusion of Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
- y. D 3350: Specification for Polyethylene Plastics Pipe and Fittings Material.
- z. F 402: Safe Handling of Solvent Cements and Primers Used for Joining Thermoplastic Pipe and Fittings.
- aa. F 405: Specification for Corrugated Polyethylene (PE) Tubing and Fittings.
- bb. F 412: Standard Terminology Relating to Plastic Piping Systems.
- cc. F 477: Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- dd. F 656: Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Pipes and Fittings.
- ee. F 714: Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
- ff. F 913: Standard Specification for Thermoplastic Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- gg. F 667: Specification for Large Diameter Corrugated Polyethylene Tubing and Fittings.

3. Federal Specification
 - a. SS-S-210A and Latest Amendments: Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints.
 4. Houston
 - a. Standard Construction Specifications for Wastewater Collection Systems, Water Lines, Storm Drainage and Street Paving, September 1996 or latest revision.
 5. Harris County Flood Control District (HCFCD)
 - a. Standard Specifications
 - b. Policy Criteria and Procedure Manual
- 1.3 Submittals
- A. In accordance with Section 013300 – Submittal Procedures of these Specifications, the following shall be submitted:
1. Certificates
 - a. Manufacturer's certificates and load tickets stating that materials meet specified requirements.
 2. Shop Drawings
 - a. Shop Drawings and details of all storm sewers and drains, including relationship to other systems and true position and details of all interfaces, connections, inlets, clean-outs, manholes, alignment and grade, changes of direction, offsets, bedding and protection, materials, manufacturer's installation and connection instructions and recommendations, and all other pertinent data.

PART 2 - PRODUCTS

- 2.1 General
- A. Products for use within Galveston right-of-way shall meet the applicable requirements.
- 2.2 Pipes And Fittings
- A. Reinforced Concrete Pipe (RCP)
1. ASTM C 76, bell-and-spigot, Class III, Wall B.
- B. Corrugated Galvanized Metal Pipe (CGMP)
1. AASHTO M 36, coated and paved in accordance with AASHTO M 190, Type C coating for pipe and Type A coating for coupling bands.
- C. PVC Pipe in accordance with the following:
-

1. ASTM D 1785.
2. ASTM D 2241.
3. ASTM D 2466.
4. ASTM D 2467.

D. PE Pipe

1. ASTM D 2447.
2. ASTM D 3035.
3. ASTM D 3350 Type PE 3408.
4. ASTM F 714 Type PE 3408.

2.3 Joints

A. Gaskets for RCP in accordance with the following:

1. Federal Specification SS-S-210A.
2. ASTM C 443.

B. All joints in PVC plastic pipe shall be solvent cemented in accordance with the following:

1. ASTM D 2564.
2. ASTM D 2672.
3. ASTM D 2855.
4. ASTM F 402.
5. ASTM F 656.

C. All joints in PE plastic pipe shall be fusion butt-welded in accordance with ASTM3261.

2.4 Drainage Structures

A. Manhole

Type as indicated on the Drawings and conforming to applicable Standards for Galveston or HCFCD Right-of-Way, or COM Property. Frame and Cover ASTM A 48 Class 35 B.

B. Inlet

Type as indicated on the Drawings and conforming to applicable Standards in Galveston or HCFCD Right-of-Way, or COM Property. Frame and Grate ASTM A 48 Class 35 B.

C. Reinforcing Steel

As specified in Section 032100 - Concrete Reinforcement of these Specifications.

D. Cast-in-Place Concrete (Class 3000)

As specified in Section 321373.19 - Cast-in-Place Concrete of these Specifications.

E. Mortar (Type M)

2.5 Cement-Stabilized Sand Backfill

A. Aggregate

Use clean sand; deleterious materials in the sand shall not exceed the following limitations, by weight:

Material removed by denatation	5.0 percent
Clay lumps	0.5 percent
Other deleterious substances such as coal, shale, coated grains of soft flaky particles.	2.0 percent

Gradation Requirements:

Retained on 3/8-in. sieve	0 percent
Retained on 1/4-in. sieve	0 - 5 percent
Retained on 20-mesh sieve	15 - 50 percent
Retained on 100-mesh sieve	80 - 100 percent

Color test per ASTM C 40, color not darker than standard color.

B. Cement

ASTM C 150, Type I or II.

C. Water

Potable, from municipal supplies approved by the State or City Health Department.

D. Mixture

Use at least 1-1/2 sacks of cement per cubic yard of mixture. Use amount of water required to provide mix suitable for mechanical hand tamping and mix in approved mixer. Stamp load tickets at plant with time of loading. Material not in place within 1-1/2 hours after loading or that has obtained an initial set will be rejected and shall be removed from the Site and replaced with new acceptable mixtures at no additional cost to COM.

2.6 Timber Posts

A. Southern Pine or Douglas Fir, pressure-treated in accordance with American Wood Preservers' Association (AWPA) Standards.

PART 3 - EXECUTION

3.1 General

- A. All storm sewer work performed within Houston right-of-way shall meet the applicable requirements.

3.2 Excavation

- A. All excavation shall be in accordance with Section 017330 - Trench Safety Systems of these Specifications.
- B. Perform excavation for storm sewer and storm sewer drainage structures to line and grade required as shown on the Drawings and as specified herein.
- C. If the excavation exceeds the permissible dimensions, extend the encasement or install pipe of higher strength, as directed.
- D. Prevent surface or ground water from flowing into excavation. Install, operate, and maintain dewatering system to convey water away from excavation. Notify the Engineer in writing of delays to the Work caused by water intrusion.

3.3 Pipe Encasement

- A. Place cement-stabilized sand bedding before laying pipe. Bedding shall be compacted and shaped to fully support the pipe.
- B. After the pipe is laid, place cement-stabilized sand beside and above the pipe in 4 in. lifts to the limits shown on the construction drawings. Compact individual lifts with a hand-operated, motorized tamper; exercise care to avoid damaging the pipe.

3.4 Laying Pipe

- A. Install and joint pipe in accordance with the pipe manufacturer's instructions and as specified herein.
- B. Provide a minimum of 6 in. clearance between storm sewer and sanitary sewer.
- C. Seal open end of pipe with plug when pipe laying operation is temporarily halted. Plug shall remain in place until operation restarts.

3.5 Backfill

- A. On completion of construction, backfill the excavation as specified in Section 312300 – Excavation, Grading, and Fill of these Specifications and in accordance with details on the construction drawings. Backfill only when the written approval of the Engineer is obtained to do so.

3.6 Construction of Manholes and Inlets

- A. General
 - 1. Construct manholes and inlets as soon as practical after sewer lines into or through the manhole or inlet locations are completed.
 - 2. Construct manholes and inlets at locations and of the type indicated. All manholes

within 9 feet of existing water lines shall be watertight.

B. Manholes

1. Provide base of the shape and size required with a minimum thickness of 12 inches.
2. Place axis of manholes directly over the centerlines of the lines, unless otherwise indicated.
3. Shall be constructed of either precast or cast-in-place concrete.

C. Inlets

1. Shall be constructed of either precast or cast-in-place concrete.

3.7 Cleanup

- A. Remove temporary structures, rubbish, waste materials, and excess excavated materials from the Site and dispose of legally.

END OF SECTION

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